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Railway Engineering and Maintenance

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The Canadian Pacific Bridge Near Lethbridge, Alberta.

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 19 **February, 1923** **Number 2**

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WE GUARANTEE, that of this issue 8,800 copies were printed; that of these 8,800 copies, 7,501 were mailed to regular paid subscribers, 11 were provided for counter and news company sales, 61 were mailed to advertisers, 35 were mailed to employees and correspondents, and 1,192 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 17,700, an average of 8,850 copies a month.

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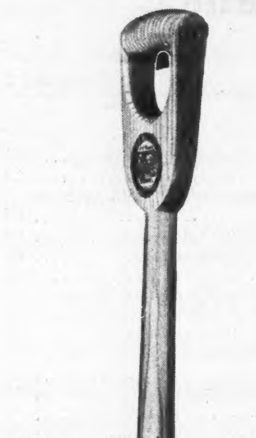

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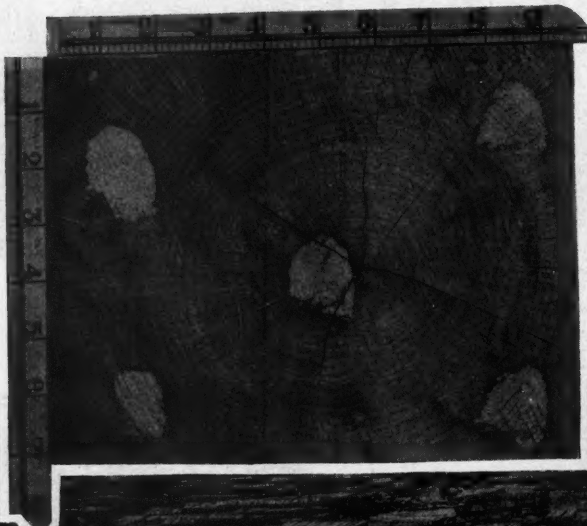

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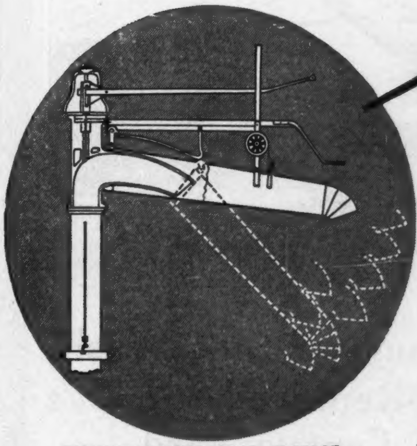

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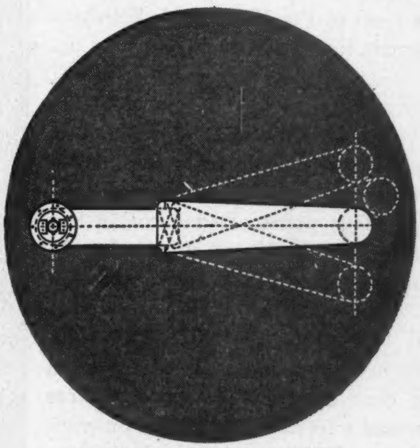

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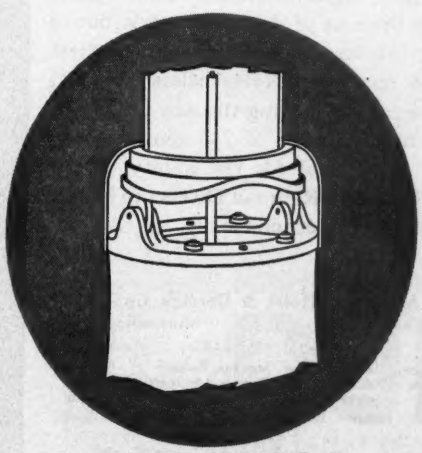

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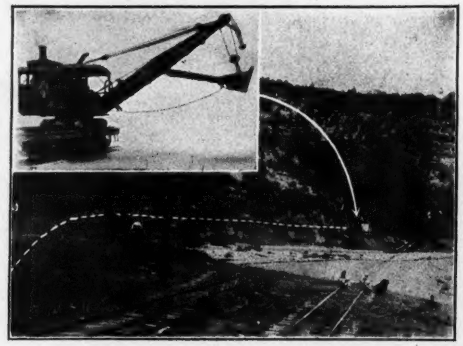

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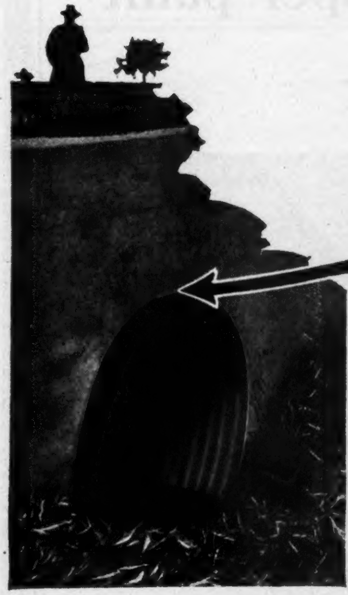

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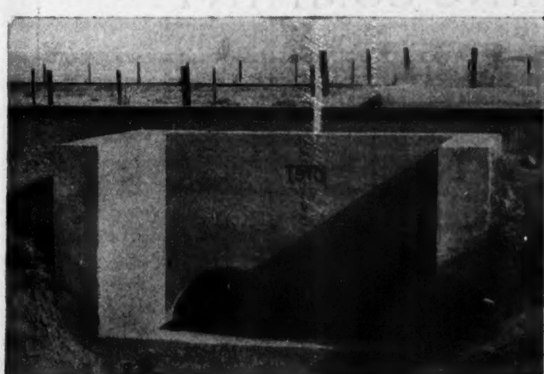

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Railway Engineering and Maintenance

Volume 19 February, 1923 No. 2

Get It Done Now

At this season of the year when weather conditions are adverse and forces are reduced to a low level, there is a tendency for maintenance of way forces to let down in their activities and to perform only those duties which are pressing. While this is perhaps a natural tendency it should be curbed at every opportunity. The same effort should be made to utilize every minute in productive work that prevails in the active summer season. This is particularly important this year in view of the outlook for a program of activities next summer which will tax the resources of the maintenance of way forces to the limit. It is evident that any work which can be done now will reduce next summer's peak load to that extent. Every effort should therefore be made to keep the forces employed in constructive work to as large an extent as possible, even if the unit costs are higher, for the minimum forces must be retained as a protection in emergencies and such routine work as they can perform is "velvet." Maintenance officers of all ranks from chief engineer to foreman can afford to scrutinize their work carefully at this time in order to select those things which can be done now, and then see that they are done.

Simple Language Is the Best

On page 70 of this issue we present an article on the handling of men that deserves special commendation. Not only does the author cover the subject in a thorough and common sense manner but he uses a style of English especially suited to the men he wishes to reach. By restricting himself to the simplest words, combined in the shortest sentences, he has succeeded in expressing himself in a manner that can be understood by almost anyone, even the foreigner as yet unskilled in the use of our language. This does not detract from the article when measured by the standards of good English composition. In fact, simplicity of expression is one of the first essentials for good English. The necessity for simple language in dealing with men in the lower ranks, especially where a considerable proportion of them are of foreign extraction, is a point well understood by every roadmaster, and as a rule the supervisory officers use the simple language in their letters and memoranda, although sometimes they do not take the trouble to make their sentences so clear that there is no chance for a double meaning. There is more room for criticism of the circulars and standard instructions which originate in the general offices. A good rule to follow in preparing such general instructions is to read the first draft over carefully to see if it is not possible to substitute shorter words for some of the longer ones and resubdivide the matter into a larger number of shorter sentences. By all means the instructions issued should be made easy to understand.

Tight Bolts and Joint Maintenance

It is trite to say that the weak point in track maintenance is the joint, for this is universally recognized. It is equally well known that the life of the rail depends more on the joint than on any other single factor. Yet after observing the manner in which joints are maintained on many roads one is inclined to the belief that while these facts are accepted in the abstract they are ignored in actual practice. In the article on this subject published on a following page the economies arising from the maintenance of tight bolts and joints are pointed out. The subject is assuming increasing importance as the weight and density of traffic are increasing and the deterioration of the joints is accelerated. Rail constitutes one of the largest items of expense in the track structure and it is the common experience that its life is limited more by deterioration at the joints than by wear throughout the remainder of its length. That this deterioration can be arrested to a large extent by adequate maintenance of the joints has been demonstrated. If this were the only economy it would justify the highest standards of joint maintenance. However, there are other important advantages, not the least of which are the retarded deterioration of the joint itself and of the ties which support it and the reduction in the amount of labor required for maintenance. Any one of these advantages justifies greater attention to the design and maintenance of the joints than is commonly accorded them. There is no better time to begin than now.

Keep the Concrete Wet

Some years ago considerable attention was attracted by a toy which provided mean by which a boy could make his own building blocks out of portland cement mortar, but for some reason many of these blocks were not a success. The reason was finally discovered. "We put the blocks on the radiator to dry and as soon as they were dry they crumbled all up." This serves to illustrate how far most people fail to realize the definite distinction between the hardening of lime mortar and the setting of portland cement. The first is accomplished by dehydration or drying out. The second takes place through a crystallization, requiring the presence of water until the process is complete. The failure to understand this distinction has been responsible for many concrete failures. Sometimes the fault is not the result of ignorance of the action of cement but of failure to appreciate the extreme evaporating powers of hot sun and dry air. Concrete work in desert areas has given considerable trouble from this cause. The water evaporates before the concrete is thoroughly cured with the result that much of it disintegrates while other portions are of extremely low strength. It is of no small interest in this connection to note that it has been found by experiment that the application of water to the con-

crete, which is weak because of this cause, may be measurably strengthened by a subsequent period of thorough saturation, even though several years have elapsed since the concrete was poured. But this example is an extreme one. The same faults have occurred to a minor degree in humid climates. Concrete must be protected against evaporation of the water of crystallization until the process of curing is thoroughly completed. Concrete constructors will do well to study carefully the article by D. A. Tomlinson on the "Art of Making Good Concrete," which appears elsewhere in this issue.

MEN PLUS LABOR SAVING MACHINES EQUALS INCREASED OUTPUT

ALL indications point to 1923 as a year of great activity on the railways. Information furnished us by 32 roads, with an aggregate mileage of 115,000, shows that these roads have already appropriated over $425,000,000 for additions and improvements to their properties. If the remaining 55 per cent of the mileage of the United States spends only three-quarters as much, the total expenditures will exceed those for any year in the last decade.

Will the roads be able to complete the programs they are laying out? This will be determined by the number of men they can secure. We are entering a period of expansion such as occurs a tmore or less regular intervals. A new condition appears this time, however, in that this revival follows a period of limited immigration, the result of restrictions which are still in force. This has greatly reduced the amount of labor now in the country and eliminates the possibility of any material relief through the arrival of any considerable number of immigrants this year.

Facing this condition, railway officers have but the alternative of adopting every possible measure that will increase the amount of work done per man. Some advantage can be obtained by starting work just as soon as the season permits. However, the relief possible from this source, while valuable, is limited. The greatest assistance will be derived from the widespread use of mechanical equipment which will enable the men available to do more and better work, and by the use of those appliances which will reduce the amount of work to be done. With the working season at hand on the southern roads and less than two months away for the northern lines, there is no time to be lost. Investigations should be undertaken immediately to ascertain those devices which will aid in increasing the amount of work which can be done. The test this year will not be the amount of the savings effected, but rather the extent to which production can be increased, although any device which will add to output will usually show lower costs as well. If past years advised labor saving equipment 1923 demands it.

A RECORD TO BE PROUD OF

The number of cars loaded with revenue freight during the week ending January 13, 1923 (the last for which figures are available), was 873,251. This exceeded the loading for any similar period in January or February in any previous year. During the four weeks ending December 30, the railways loaded 680,000 more cars of freight than they did in the corresponding period of 1921; 456,432 more than in the peak year of 1920; 481,502 more than in 1919; and 568,668 more than in 1918.

The amount of freight moved in the 21 weeks from the opening of the coal mines late in August to January 13 was larger than in the corresponding 21 weeks of any previous year, being 678,056 greater than in the record year of 1920. In 40 out of the last 41 weeks the railways moved more cars of "merchandise and miscellaneous" freight than they have ever handled in the same weeks of any previous year.

This traffic has been handled in spite of the nation-wide strike of more than a quarter of a million shop employees. This record has been made possible by the whole-hearted co-operation of the great majority of the employees who remained loyal to their managements and enabled the roads to render a greater service to the country than ever before.

IS IT WORTH WHILE?

THE reports presented by the producers of railway cross ties at their recent convention in New Orleans and abstracted on page 48 emphasize the chaotic condition which is now developing in that industry as a result of the erratic policy which the railways pursue in making their purchases. Last year they withdrew from the market in large measure, with the result that prices declined greatly and production fell to a low point. Now conditions are reversed. The railways have not only re-entered the market, but they are competing so actively with each other for the ties available that the market is approaching a state of demoralization.

Illustrative of the conditions now prevailing, one road which came into the market a few weeks ago for a large number of ties accompanies its inquiry by an offer 25 cents above the prices then prevailing. In some localities the condition is such that the arrival of a wagon-load of ties is the occasion for an auction to the highest bidder. Under such conditions it is not surprising that deviations from specifications, the "grading up" of ties and other irregular practices which add to the cost of the ties to the road are being resorted to.

This bidding for ties is designed to stimulate production and thereby to bring out a larger number, but past records do not indicte that tnt is necessarily the result. Where ties are produced in saw mills and production is based on the relative prices of ties and lumber, some increase is brought about. However, a large proportion of the ties are hewn by woodsmen, who bring out a few at a time, and, like the farmer who refuses to sell his grain while prices are rising, the woodsmen hold back their output at times such as this awaiting still further increases in prices, with the result that the production is actually reduced.

While this condition is a very real one, the question may properly be raised as to its necessity. It is brought about by the wide fluctuations in purchases by the roads. That these fluctuations are unnecessary is evident. The deterioration of the ties is relatively constant. Their replacement should follow with similar uniformity if a uniform strength of the track is to be maintained. If the producers knew that the railways would come into the market for approximately the same number of ties each year they could organize to produce a uniform number of ties and thus eliminate the runaway market which is now developing and which is adding 50 per cent and more to the cost of the ties. To maintain their present policy is costing the railways many millions of dollars. This is a tax on the maintenance of way department. Those officers responsible for the maintenance of tracks may well question the necessity for this expense. By bringing this matter to the attention of their managements em-

phatically they can do much to place the purchase of ties on a businesslike basis and aid in effecting large reductions in the cost of conducting their department.

IT IS THE KIND OF A MAN HE IS

L. W. BALDWIN, in an interview which is published on page 51, lays emphasis on the fundamental truth that it is character rather than experience which determines a man's real worth. In other words, he contends that experience is of value to a man primarily to the extent that it builds up his character, rather than because of the detailed facts which he learns as a result of that experience. It would seem, however, that the two elements overlap. The training which builds up a man's character must undoubtedly teach him much which will prove of value later in life. This thought brings to mind the attention which the young man must give to the positions which he finds open to him. The young man who enters railway service, whether he be a graduate of an eighth grade or of a college, must bear in mind that his compensation in any position is made up of two parts; that which comes to him in his pay check and that which represents the training he receives in his daily work. He will find in most cases that if his pay check is relatively large, the amount he receives in training will be small.

On the other hand, if he is holding a position in which he is obtaining valuable training, he must expect that the compensation he receives in the form of money will not be so large. In general, then, during the earlier years of his life as long as a man feels that he is learning, developing and growing, he should not object if the amount he receives in the pay check is relatively small, for he can have the satisfaction of knowing that the training he is receiving will be of immeasurable help in obtaining a more lucrative position later. If, however, he finds that he is not learning, that his efforts to increase his knowledge are being hampered, it may be advisable for him to look for another job. However, he must bear in mind that the habit of jumping jobs is a bad one to develop and that while a few years of drifting about will unquestionably broaden a man, a confirmed "boomer" gets nowhere. The fellow who sets out on a search for the ideal situation will never find it. It doesn't exist.

HAVE YOUR PLANS WELL LAID

OTHER things being equal that executive will be most successful who has his plans laid furthest in advance. This truth applies emphatically to the maintenance of way officer because his responsibilities are primarily of an executive or managerial nature. No man can direct the work of others successfully unless he prepares his plan, so far ahead that each man is assured an assignment of some task well in advance of his completion of the one previously given him. This not only implies a knowledge of what work must be done but requires also that all material and equipment necessary are at hand when the men are ready to do the work.

The position of the maintenance officer is oftentimes made more difficult because the management does not give him sufficient advance information as to the work it expects to authorize and he is not advised whether the budget will be approved in its entirety or only in part. On the other hand, once authority is given him he is expected to conduct his operations from the very start to the full measure of the appropriation. He may be criticized as severely for not making full use of his allowance as for exceeding it. To meet this requirement means preparation. Knowing what was asked for in the budget he must determine in advance what materials and equipment, what forces and what supervisory and technical organization will be needed to carry out the full program or any part of it. He must also have his lines out for the additional labor and trained assistants that may be required so that he can act quickly as soon as the word is given. If he does not do this it will be very difficult for him to "catch up."

NEW BOOKS

Manual of the American Railway Engineering Association. 1,004 pages, illustrated, 6 in. by 9 in. Bound in paper, cloth or leather. Published by the association, E. H. Fritch, secretary, 431 South Dearborn street, Chicago.

As the name indicates, this is a compilation of standards of recommended practice of the association and supersedes the manual published in 1915. The date of the present volume is 1921, indicating that it is up to date for matters adopted by the association up to and including the convention of that year. The recommended practice of the association, as covered in this volume, represents the work of the various standing committees which has been presented for inclusion in the manual and accepted as such by the annual conventions. An idea of the progress being made by the association to this end is evidenced by the increase in the size of these manuals as they have been issued at intervals of approximately five years. Thus, the 1911 manual contained 477 pages; that of 1915, 680 pages, and the present volume 1,004 pages. However, the use of India paper in the present volume has made it possible to publish a book that is no thicker than its predecessors. Material in the manual may be subdivided into several classes: Specifications for workmanship and material; standard practice in inspection, workmanship and the conduct of routine maintenance of way and engineering work on the railroads; standard designs covering track and roadway structures, equipment, tools, etc.; and miscellaneous data of use in maintenance of way practice.

Handbook of Construction Costs. By Halbert P. Gillette, editor of Engineering and Contracting. 1,734 pages, illustrated, 4½ in. by 6½ in. Bound in flexible leather. Published by McGraw-Hill Book Company, New York City.

The relation of this volume to the other books on costs data by the same author, including his well-known "Handbook of Costs Data," is explained in the preface to this latest volume, namely, that the new book supplements and does not supersede the earlier works. This idea is borne out in an examination of the book since the material it contains is such as has become available subsequent to the publication of the earlier volumes. The book consists for the most part of a detailed report of the costs of conducting a wide variety of construction operations, gathered from various sources, although primarily from current engineering periodicals. While the descriptive matter contained in the articles has been condensed for the necessity of economy in space in a book of this kind, care has been taken to insure that the facts are presented in sufficient detail so as to give the reader a thorough understanding of the conditions under which the costs were incurred. The data cover a wide range as to time of origin, some of them dating back as far as 1906, but as the author points out with respect to the material in his earlier books on cost data, the value of such material is not seriously impaired by lapse of time. The first two chapters of this book, on engineering economics and prices and wages, cover the subject of cost in a large way and serve as a valuable introduction to the detailed cost analyses to be found in the remaining chapters. The arrangement of the book is orderly with chapter subdivisions for the various classes of subjects.

The Tie Producers and Guests at New Orleans.

Roads Face Acute Shortage of Ties and Higher Prices

Reports From All Quarters Indicate That Increased Demand Is Demoralizing Market

THE outstanding feature of the fifth annual meeting of the National Association of Railroad Tie Producers, which was held at the St. Charles hotel, New Orleans, La., on January 25-26, was the reports from all districts of the greatly increased demand for cross ties after a long period of restricted demand. Approximately 50 members were in attendance at this meeting, which convened immediately following the close of the convention of the American Wood Preservers' Association. John H. Johnson (B. Johnson & Son, Richmond, Ind.), president of the association, presided. The association suffered a severe loss a short time prior to the convention through the death of its secretary, Warren C. Nixon, who had done much to promote its interests.

Conditions in Tie-Producing Areas

In the South Eastern district, including Tennessee, Kentucky, Alabama, Mississippi and Georgia, the production in 1922 was only 50 per cent of that in 1920 (the year of maximum output). It began to increase late in the summer and is showing indications of still further development, although the high price of cotton is attracting labor from the woods to the farms. A further increase in price is anticipated, which will stimulate production to some extent, but not up to the normal output of pre-war years.

In the North Eastern district, including Ohio, West Virginia, Virginia, Pennsylvania and the states along the north Atlantic seaboard, production is increasing from the low point in 1922, although the extent to which it can be increased still further is dependent upon labor conditions. The indications are that the production will be considerably above that of last year.

Reports from the South Central district, including Arkansas, Missouri, Oklahoma, Louisiana and Texas, showed that the production fell to a low point early in 1922 with large stocks on hand and little demand. The roads began to come into the market in the summer and fall and production was stimulated as prices advanced until the total output for the year was approximately 50 per cent of normal. The producers entered 1923 with almost no stocks. The roads are now buying all ties in sight at prices 50 per cent higher than a year ago with prospects of still further increases.

In the North Central district, including Wisconsin. Minnesota and adjacent states, the buying early in 1922 was very limited, with prices below the cost of production. With an increasing demand after May 1, prices increased and stocks on hand were soon disposed of. Indications point to a production in 1923 of approximately 50 to 60 per cent of that of 1920, much of the hardwood now going into lumber instead of ties. Prices are rising in this territory and there will be a ready sale for all ties produced.

Reports from the Rocky Mountain district, including Montana, Wyoming and Colorado, indicate that the prospects are favorable for a normal production of ties in this area, the principal limitation being the supply of labor available. The production in 1922 was approximately normal; practically all of the ties produced in this area were cut on direct orders from the railroads.

On the Pacific coast few mills made any effort to secure tie business in 1922 and practically no ties were produced for other than local consumption. During the last 60 days sufficient inquiries have been received from eastern and western roads to offer the mills a large amount of business at profitable prices, but many mills are showing little interest in these inquiries because of the higher prices which can be realized from the conversion of this timber into lumber.

Arresting the Checking of Ties

By C. B. Mitchell

Assistant to President, National Lumber and Creosoting Co., Texarkana, Tex.

Oak timbers produced in adjacent locations will frequently act radically different with respect to checking. This no doubt accounts for the generally accepted belief that it is best to apply these irons in the ends of every tie immediately after its manufacture. My opinion is that the best method is to apply these irons periodically to the ties as checks develop. The first general examination to determine which ones justify the insertion of these irons should be made two to four months after the ties are manufactured, depending on the season of year in which they are cut.

As a rule, within about 60 days following their manufacture, ties will either develop these season checks in a mild form so that the remedy can be applied promptly, or will carry such indications as will enable an experienced man to determine readily whether the irons should be inserted. It has been our experience that up to 15 per cent check in a manner to prompt the use of irons. Ordinarily a pole tie with a large percentage of sapwood will crack in a more pronounced manner in seasoning than

others. The fact that the slightest obstruction will serve to arrest this season checking of woods (especially oak) is demonstrated by the practice of numerous tie makers of chopping a "nick" about 2½ ft. from each end (especially those made from young overcup), whereby the tendency of the wood to split at the ends is diverted to that section of the wood in which the abrasion or "nick" is placed. While there is no doubt that this serves to retard or prevent excessive season checking, the judicious use of the standard "S" irons represents most effective procedure.

Discussion

Howard Andrews (Nashville Tie Company) described a practice which he has followed of applying a band of soft iron to ties which have developed serious checks and then drawing the tie back to its original form and closing the checks by inserting wedges within the bands, after which an S-iron is applied.

George E. Rex advocated the general use of S-irons. He stated that it was his practice originally to apply these irons only to ties that gave indications of checking, but this required periodic inspection and the application of irons to individual ties, which cost as much as their universal application.

Bringing Ties Out by Water

By T. J. Moss

Vice-President, T. J. Moss Tie, Co., St. Louis, Mo.

A considerable percentage of the ties produced in the Mississippi Valley are now being cut along creeks and rivers on which they are transported to shipping points on the railroads. There are three principal ways of transporting ties by water—driving, rafting and towing on barges.

On small streams, which have fairly strong currents without many deep holes for ties to sink into, the ties are generally driven loose. After they have seasoned from 6 to 12 months they are thrown into the streams and allowed to float down stream. A crew of men follow them, keeping them from lodging on bars and jamming. Frequently shoals are encountered, too shallow to float the ties over. In such cases they are cribbed up to construct a narrow chute, causing all the water to flow through it, which raises the depth of water in the chute enough to float the ties. At destination a boom is built across the river to catch the ties. From this point they are allowed to drift down in small lots to the apparatus which pulls them out of the water. This can be a locomotive crane, an endless chain, or even wagons and teams in some cases.

Ties are driven only in the summer, except on very small creeks that have driving water only in the winter, which creeks are usually tributary to larger streams. The ties are taken out and yarded at the mouth of the creek, where they are allowed to season until the big drive in the summer.

When sudden rains come the rivers rise, causing the ties to drift back into the timber, from which they have to be hauled to the river again. These are what we call "throw-outs." There are few large drives without some small "throw-outs," and frequently large and expensive ones occur. It is common to try to wait until the rainy season is over, to avoid these "throw-outs," although in some cases producers wait too long and extra expense is incurred to keep the ties from lodging and getting them over shoals.

The greatest danger occurs when a large rise comes after the ties have reached the boom, for these booms are generally strong enough to hold an ordinary rise, but not an unusual rise, which occurs every few years in every stream. In an ordinary rise some ties dive under the boom and get away. When ties once go over or pass under the boom it is very difficult to get them back, if it is possible at all.

A number of ties always become "water-logged" and sink. If these ties are not caught and nailed between two "floaters" in time, they are likely to sink into deep holes and be lost.

On streams that are too large and have too many deep holes for ties to sink into, but are not navigable for tow boats, ties are generally rafted. This is done by nailing ties into blocks of about twenty each with binders. These blocks are fastened to each other by means of "coupling poles," which are usually light hickory saplings. One is used between each two blocks so as to give the raft flexibility in going around bends. Rafts are guided by what is known as "snub poles."

On some large streams the blocks are fastened together in layers, two or more deep, and are bulked two or three tie lengths wide, which gives them more of the appearance of a log raft. These are generally handled by motor boats.

Rafting is safer than driving, but much more costly. The cost of nails and binders, and the labor of nailing them in, is quite great. Rafts are sometimes broken up in getting over shoals, or in hitting rocks or other obstructions, and it is very difficult to get them back together. The most usual cause of the breaking up of a raft is waves caused by wind in high water, these waves giving the ties an oscillating motion which pulls the nails out.

While towing ties in barges is undoubtedly the safest method of transporting them by water, more ties are lost on streams waiting to be towed than from any other cause. Such a stream must be quite large to be navigable for tow boats, and a 30 or 40 ft. difference between low and high water stages is not unusual. There is hardly a winter that many ties are not overflowed on such streams as the Tennessee river, a large percentage of which are washed away. The ones that are held by means of booms and cribbing very high are, of course, soaked with mud and water, and unless they are repiled immediately after the water recedes or are towed away they will be damaged greatly. Most of the companies operating on such streams try to get their ties towed out before the high water season, but this is often impossible. If the river is low when the tow boat is there, there are always a number of landings that the boat cannot reach, while if the river is high there will be some landings where the timber interferes, holding the boat too far out into the river to load.

Estimating Cross Tie Timber

By Howard Andrews

President, Nashville Tie Co., Nashville, Tenn.

The most common method of estimating the amount of timber on a tract is to measure scattered acres and use these as an average for the whole tract. A tie maker can look at a tree and tell how many ties it will make, figuring the number of logs which can be cut from the tree and the number of ties each log will make, getting as accurate results as a mathematician would by climbing the tree with a ladder and taking measurements.

In estimating tie timber it is figured that a stick or log under 10 in. in diameter will not make a tie, a log 10 in. in diameter will make a 6 in. by 8 in. tie; a log 11 in. in diameter will make a 7 in. by 8 in. tie, and a log 12 in. in diameter will make a 7 in. by 9 in. tie, while a 14-in. log will probably make two 6 in. by 8 in. ties. Beyond that diameter certain different combinations, such as 15 in., 16 in. and 17 in. logs, may make two 6 in. by 8 in.

ties, or one 6 in. by 8 in. tie and one large or two small ties, or two large ties. An 18-in. log should make three 6 in. by 8 in. ties; a 20-in. log should make four 6 in. by 8 in. ties, and a log 30 in. in diameter should make about ten ties. One can count on about one tie to each inch in diameter for the next six or eight inches. Most of the tie timber available today is small and I think that at least 80 per cent of the tie timber will make only one tie to the log. Few ties are made from trees that will cut over four ties to the log. If the ties are to be hewn from large timber the question of "twisting timber" is to be considered, making it impossible to get square sides to a tie by the ordinary splitting process.

A good estimator can go over 500 to 1,000 acres in a day and should not miss the actual number of ties more than 10 per cent. The quality of the timber must also be considered carefully.

The Value of Gum Wood as Tie Material

By J. R. Keig

Manager, Hewn Tie and Piling Department, Kirby Lumber Co., Silsbee, Tex.

For a great many years there has been more or less prejudice against the use of gum wood as tie material. The majority of the railroads have found it undesirable. However, some roads, more especially the Santa Fe, were able to handle this wood successfully. This road realized that if gum ties were moved from the woods immediately to the track or loading point, were properly stacked for inspection, or loaded promptly for the treating plant, received the necessary care during the seasoning process and were treated according to the most improved methods, there could be no better ties. The gum tie is so highly thought of by the maintenance men on this road that the calls are usually for gum in preference to any other class of wood. This applies to both cross and switch ties.

The principal species of gum are red or sweet gum, black gum, cotton gum or tupelo. The gum family is found in the lowlands, usually along the rivers.

The Santa Fe has absolute control over the production of ties on its lines in the territory where gum ties are produced. This is very important where there is a possibility of ties being left lying in the woods or on the right of way too long after being produced.

When they are hauled to the right of way they are not accepted unless indications show that they have been brought out almost immediately. They are stacked on the right of way (two by seven) with plenty of air space to facilitate inspection and improve the seasoning conditions, and every precaution is taken to load them in cars before there is any chance for infection.

The Santa Fe has built cars for the transportation of ties. They are practically skeleton cars which allow plenty of air circulation. All ties are stenciled at the time of inspection, showing the month in which they were accepted. This enables the Santa Fe to get an absolute check on the age of ties on the right of way.

When the ties are received at the treating plant they are stacked with each inspection by itself, or if it is not practical to do this, the ties of not more than three different inspections are put in one stack. This is done to insure the treatment of the oldest ties first.

When ties are ready for treatment, they are loaded on flat cars and hauled to a boring and adzing machine. The first unit of this machine is composed of two saws, which cut from one-fourth to one-half inch off of each end of the tie, or more of the tie happens to be over-length. This process not only makes all ties of equal length, but enables the plant men to make an inspection inside every tie.

The ties are given a thorough treatment, usually with creosote, and are stored on the yard after treatment or shipped to one of the numerous storage yards on the line, where they are held until in proper condition for use.

A system has been worked out whereby gum ties (which are considered hardwood) are used only on curves of two degrees or over and in exceedingly heavy main line tracks, heavy switching leads and certain lines in mountainous territory. They are inserted with care, which means the use of tie tongs and without undue abrasion. Tie plates are used on all ties.

The peculiar structure of gum wood makes it particularly susceptible to preservative treatment and when once thoroughly treated it retains the preservative better than most other woods. This has a very beneficial effect on the mechanical life of the ties in track. The gum tie is naturally quite resilient and the retention of creosote and consequent lubrication of the fibres of the wood tend to lengthen the mechanical life. There is less plate cutting of the tie and the spike-holding qualities are excellent.

The Santa Fe has one instance where gum ties have given 13 years' service to date with only one per cent renewals. The Santa Fe's success with gum ties is undoubtedly due to adherence to rigid instructions in the various departments through which the gum tie passes from stump to insertion in the track and also the proper protection thereafter in order to insure the necessary life.

Discussion

In reply to a question regarding the spike-holding properties of gum ties, Mr. Keig stated that they will hold better than pine and as well as oak.

G. E. Rex (National Lumber & Creosoting Company) stated that the Santa Fe began using gum ties in large quantities in 1906 with such success that at least 22 of the division superintendents will now take a gum tie in preference to other timbers when they are available. He maintained that it made no difference in what season these ties were cut if they are removed from the woods promptly and proper care is exercised in seasoning them.

Other Papers

Following the presentation of these papers, R. J. Witherell, vice-president, L. D. Leach & Co., Chicago, presented a discussion of the Comparative Costs of Present Day Tie Production. The Shipping Weights of Ties Before and After Treatment were discussed by J. J. Schlafly, Potosi Tie & Lumber Company, St. Louis, Mo; H. G. McIlhinney, Kettle River Company, Madison, Ill., and J. S. Penney, T. J. Moss Tie Company, St. Louis, Mo.

At the concluding session of the convention the following officers were elected for the ensuing year: President, T. Harmount, the Harmount Tie & Lumber Co., Chillicothe, Ohio; first vice-president, R. J. Witherell, L. D. Leach & Co., Chicago; second vice-president, A. H. Onstad, Weyerhauser Timber Company, Tacoma, Wash.; secretary, J. S. Penney, T. J. Moss Tie Company, St. Louis, Mo.; treasurer, Ben J. Finch, Finch Brothers, Duluth, Minn.. Directors—Pacific coast: H. M. Cochran, Union Lumber Company, San Francisco, Cal.; Rocky Mountain district, George Loff, Standard Timber Company, Evanston, Wyo.; North Central district, H. S. Gilkey, Pendleton & Gilkey, Minneapolis, Minn.; South Central district, Alfred Bennett, Bennett-Field Tie Company, Chicago; North Eastern district, G. D. Baker, Baker Wood Preserving Company, Washington Court House, Ohio; South Eastern district, C. D. Christian, Standard Tie & Lumber Company, Meridian, Miss. Kansas City was selected as the location for the next convention.

"It Isn't So Much the Job He Holds As the Kind of Man He Is"

In the Opinion of L. W. Baldwin, a Man's Personal Characteristics Are More Important Than the Particular Nature of His Experience

By **WALTER S. LACHER**

IN 1896 a certain construction party on the Illinois Central included a chainman who had recently graduated from an eastern engineering school. Boyish in appearance and with a cheerful manner that was contagious, he made friends readily, but there was little about him that attracted immediate attention except as it was noted that he had a faculty for sticking to a job until it was finished and that he had little to say about his work unless it was worth saying or until he was sure he could back it up.

Although 24 years have served to translate him to operating vice-president of the Illinois Central, L. Warrington Baldwin possesses substantially the same fundamental characteristics today that identified him as a chainman in 1896. With an unlimited supply of energy, which can seemingly be transmitted to those about him, he still retains that spirit of friendliness that enlists the whole-hearted efforts of others through cheerful willingness rather than enforced obedience.

A college education gives one only a general conception of the duties of an assistant on railway construction. Likewise, it affords the young man but a vague idea of railway organization as a whole. Therefore, it takes him some time to find himself, to develop his particular interests, to determine what branch of the service offers the greatest appeal.

L. W. Baldwin
Operating Vice-President Illinois Central.

"When I entered railway service," said Mr. Baldwin, "I didn't have a very definite idea of what I wanted to do. Later when I became assistant engineer on maintenance, I made up my mind that I wanted to get into real maintenance of way work. It seemed to offer more opportunities than construction."

"Were you soon afforded an opportunity to follow this inclination?" I asked.

"No, I was not. A short time later, in September, 1898, I was assigned to construction work. It had been decided to build into Omaha and I was instructed to make the location from Tara to the Missouri river. Later I was given a residency on construction. This occupied about 18 months, so in all it was 3½ years from the time I entered the employ of the Illinois Central till I was appointed track supervisor."

"Did your new work give you any particular trouble at the start?"

"No, I can't say that it did. I was once told that it is a good plan to keep your mouth closed and your ears open, that it is better not to say anything unless you are absolutely sure you know what you are talking about. I don't mean by this that I took the job without considerable knowledge of it. My previous experience had given me plenty of opportunity to become familiar with track work."

"Do you think that experience as either a track laborer or foreman is necessary before a man can be a successful supervisor? I ask that question because I recently heard the subject discussed by a group of supervisors and roadmasters who were very positive that actual experience in track work was a requisite for anyone to qualify as a supervisor, no matter what other experience or training he may have had."

"It may be that the opinions of these roadmasters were based on experience with college men who did not make good. Everyone knows that no amount of education will make a man a success at handling men if he hasn't it in him. But if a man can develop the faculty for leading others and is thoroughly square with his men and wins their respect, he can make his way. It isn't so much the kind of a start a man gets or the kind of a job he holds, as the kind of a man he is. Of course, actual track experience is a big help and the fellow who has had it will usually make a better supervisor for the first year or two than the man who hasn't had the training. But after that other factors will influence a man's success more than his experience."

"How did you come to enter the operating department?"

"After a year as supervisor I was made roadmaster, a position which on the Illinois Central is practically the

same as division engineer on most other roads, and while serving in this capacity I came to the conclusion that I wanted to get into transportation work and after about 3½ years as a roadmaster I got my chance in an appointment as trainmaster."

"That was a rather abrupt change of work, was it not?"

"No, I can't say that it was. I don't think that anyone who had had experience similar to mine would have any trouble in making good as a trainmaster, because as a roadmaster I had plenty of opportunity to come in contact with the operating department."

In April, 1906, after two years' service as trainmaster, Mr. Baldwin was promoted to superintendent, a position he held for three years, when he was again given a direct contact with maintenance of way problems in the position of system engineer maintenance of way. But his primary interest in transportation persisted and after another three years he succeeded in obtaining a transfer to the operating department as superintendent of the Louisville division. That his leanings toward operation were on a sound footing was demonstrated in January, 1915, by his promotion to general superintendent, Southern lines at New Orleans, and again only a year later to vice-president and general manager of the Central of Georgia. In January, 1918, when President Markham of the Illinois Central was appointed director of the Southern region of the United States Railroad Administration at Atlanta, he selected Mr. Baldwin for the position of assistant regional director. Later they were both transferred to the newly created Allegheny region, and when Mr. Markham retired to resume his duties as president of the Illinois Central in October, 1919, Mr. Baldwin succeeded him as director of the Allegheny region, a position he occupied until the end of Federal control, when he was elected to his present position.

"Your experience as a railway officer and your opportunities to observe others in various situations must have caused you to develop certain well-defined ideas on the requisites for success as an executive."

"I do not think that my ideas on that subject are at all out of the ordinary. The main thing is unceasing application to work. Of course, that won't make a man a success alone unless he acquires an ability to handle men and thoroughly understands the things that go on around him. He must be able to use his head."

"What do you expect of your subordinates?"

"I expect them to get results. That is, I expect them to be willing to make some real sacrifices in order to get the work done. Or, to put it in other words, I expect of my subordinates exactly what I expect of myself or what I have found that my superiors expect of me."

"Doesn't a large organization impose serious obstacles in the way of the higher officer by denying him an opportunity to deal directly with the men further down in the ranks?"

"It is a rule of all organizations that matters must be handled through the proper channels. No executive can afford to do otherwise. There are, of course, certain legitimate ways for the executive to get in personal touch with the subordinate officers. It may be done in the course of road travel or through staff meetings. For example, on the Illinois Central we have division officers meetings at central headquarters every month. These meetings not only give us a chance to become well acquainted with all the officers, but also enable us to reach all the men directly when it is necessary to drive home some particular point."

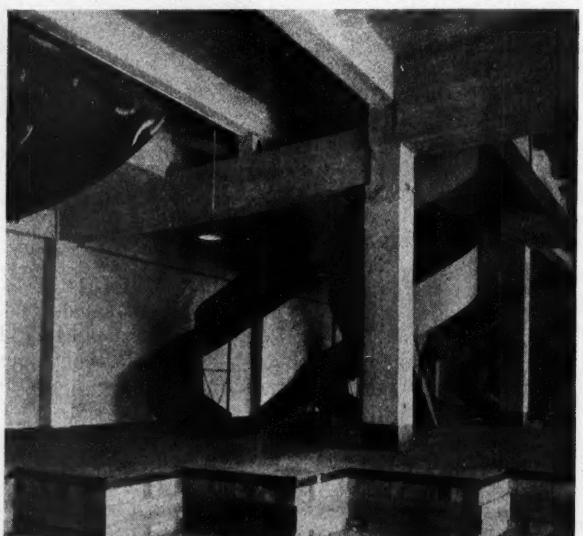
"Do you think that apprenticeship courses are of an advantage in training men?"

"No. We had an apprenticeship course of that kind on the Illinois Central about 20 years ago, but our experience was not very favorable. It is true that a number of men who are now officers of the Illinois Central are graduates of that course, and that the road profited in their development, but it was our general experience that too large a percentage of those who started the course dropped out and we found it didn't pay."

"You believe then that a man should make his way without some special plan for giving him a general experience and that he can obtain recognition without it."

"Yes, I know he can. The technical man also must remember that he has certain specific advantages over the man who has not had the opportunity to go to college. His main advantage as I see it lies in the training he has in intensive study and concentration. He also develops a certain degree of polish, or, you might say, he has had the rough edges knocked off him. On the other hand, he has probably acquired some other traits that need to be straightened out after he gets into practical work. If, for example, he has been rather popular at school he has acquired a certain over-confidence that has got to be knocked out of him."

"There are, of course," continued Mr. Baldwin, "two obstacles in his way when he gets into practical railway experience. One is that he finds it very hard to confine himself to what we might call the 'small work' that is assigned to him. The other is that his progress away from this 'small work' may be somewhat slow. These two things have caused many young men to leave railway work. However, I believe if the young fellow will apply himself in spite of this discouragement, if he is fair in the treatment of others and loyal to his employer, he will eventually succeed. The young technical man on the railroad who feels discouraged should bear in mind that the proportion of men with higher education who succeed on the railroads is far greater than the percentage of those without it. On the other hand, he must keep definitely in mind that a man does not need to go to college to be educated. Many railroad men with only a high school training have gone way to the top because they continued their studies after they left school. Those men are better educated, in the true sense, than many a man who has a diploma. The man whose education stops when he graduates never gets very far."



Mail Chutes in the New Railway Mail Terminal at Chicago

The Columbia Bridge, Philadelphia & Reading, Philadelphia, Pa.

Promoting The Art of Making Good Concrete*

The Advantage of Adequate Moisture in Curing and the Requirements of Waterproof Construction

By D. A. Tomlinson

Manager Railways Bureau, Portland Cement Association, Chicago.

THIS IS the fourth and last of the series of articles outlining the principles governing the making of good concrete based on laboratory studies, experiments and investigations of practical work. This article covers two independent branches in the art of making concrete as indicated by the two subheadings below.

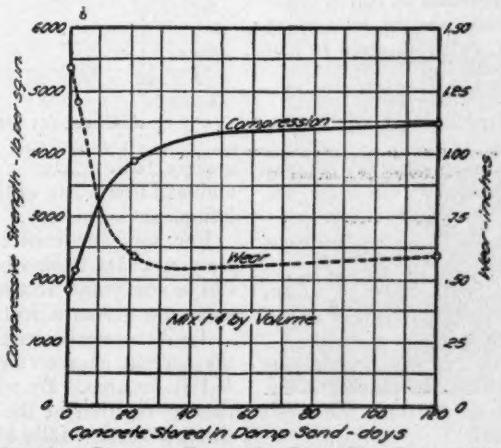
Keeping Concrete Damp Adds Strength

Careful distinction should be made between the requirements of concrete for water during the mixing operation and in curing. A safe rule to follow is to use the smallest quantity of *mixing* water that will produce a sufficiently plastic mixture for the work in hand, and then to give the surface of the concrete as much *curing* water as possible after the concrete is placed.

Concrete hardens because of chemical reactions between portland cement and water. Down to an amount less than can be used in construction work, the smaller the quantity of mixing water the stronger will be the concrete. Therefore, the quantity of mixing water should be reduced as far as possible. However, once the concrete is placed, conditions change and ample curing water should be provided.

The chemical reactions of the hardening of concrete are slow, and if sufficient moisture is not present they cannot be completed. The mixing water essential to proper hardening of freshly placed concrete is often lost by absorption or evaporation even after the concrete has begun to harden. Under such conditions concrete attains only part of its potential strength. Therefore, the water content of freshly placed concrete should be conserved. Keeping concrete damp during its early hardening period, or, in other words, providing plenty of curing water, prevents evaporation of necessary moisture, and permits concrete to harden under favorable conditions.

Tests made at the Structural Materials Research Laboratory, Lewis Institute, Chicago, show that protection during the early hardening period greatly increases the strength and resistance to wear of concrete. The accompanying chart gives a summary of the results of these tests. All specimens were tested at the same age—four months. One set was allowed to harden in air for the full four months; the second set was stored in damp sand for 3 days and in air for the remaining 117 days; the third set was stored in damp sand 21 days and in air the remaining 99 days; while the fourth set was stored in damp sand the full 120 days, and was tested while still damp. Thus the increased strength and resistance to wear was caused solely by the better curing conditions provided.



Keeping Concrete Damp the First Ten Days Adds 75 Per Cent to Its Compressive Strength

It reduces the amount of wear 40 per cent, or vice versa, increases the resistance to wear 65 per cent. Three weeks adds still more strength and hardness.

Protect Concrete While Hardening

Note that keeping concrete damp for the first 10 days increased its compressive strength 75 per cent, for three weeks 115 per cent, and for four months 145 per cent. Note also that keeping concrete damp for the first 10 days decreased the amount of wear 40 per

*The fourth and last of a series of articles on the principles of making good concrete, the previous articles having been published in the issues of October and December, 1922, and of January, 1923.

cent, and for three weeks 55 per cent. Keeping concrete damp for four months did not cause a further decrease in wear, but the specimens were tested damp. Had they been allowed to dry out for a few days before being tested, the amount of wear would probably have been less.

Reversing the form of these wear results, 10 days' protection increased the resistance to wear of concrete 65 per cent, and three weeks' protection 120 per cent. Thus proper curing increases the resistance to wear of concrete almost in the same proportion as the compressive strength. Needless to say, resistance to wear is an important consideration in floors, pavements and platforms.

Methods of Protecting

Freshly placed concrete can be kept damp in several ways. Drenching the subbase and forms with water before concrete is placed will reduce absorption. Horizontal surfaces, such as floors and pavements, can be covered with damp sand the day after they are laid, when they have hardened sufficiently to prevent pitting the surface, and kept damp by frequent sprinkling. Sometimes small dikes of clay are built around a section of floor or pavement which is then flooded with water. Vertical surfaces can be kept damp by frequent sprinkling of the forms or exposed concrete. Sometimes walls are covered with canvas or burlap, which is drenched with water several times a day.

Keeping concrete damp the first 10 days, which costs practically nothing, will give the owner over 65 per cent better value for his money. Three weeks' protection will give still greater increase in value. There is nothing that can be done to concrete that will pay such big dividends in better concrete as proper use of water in mixing and in curing. Remember: *Less water in mixing, more water in curing.*

Watertight Concrete Means Good Concrete

Concrete made from properly selected aggregates, combined with portland cement in suitable proportions, when thoroughly mixed to the right consistency, carefully placed, and adequately protected during early hardening, will be watertight under all ordinary conditions.

Watertight concrete means good concrete. A few fundamental principles of good construction should be carefully observed. These can be summarized as follows:

1. All portions of the structure should be strong enough to resist the head of water, either internal or external, to which the concrete may be subjected.
2. Use clean, well graded aggregates.
3. Use a relatively rich mixture, a 1:2:3, or, better, 1:1½:3.
4. Use the minimum amount of mixing water that will give a workable, plastic consistency; not over six gallons per sack of cement.
5. Mix the concrete thoroughly, at least 1½ minutes in a batch mixer.
6. Place the concrete carefully in layers 6 to 12 in. deep, spading or rodding it thoroughly to prevent the formation of stone pockets or voids.
7. If possible, place the concrete in one continuous operation to avoid construction joints. If placing is interrupted, be sure to get a good bond between the fresh concrete and that placed previously.
8. Keep the concrete warm and damp for the first 10 days.

These principles of good concrete construction are all emphasized in the Progress Report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, issued in June, 1921. Failure to observe these principles may result in unsatisfactory, porous concrete; care in using them will give strong concrete.

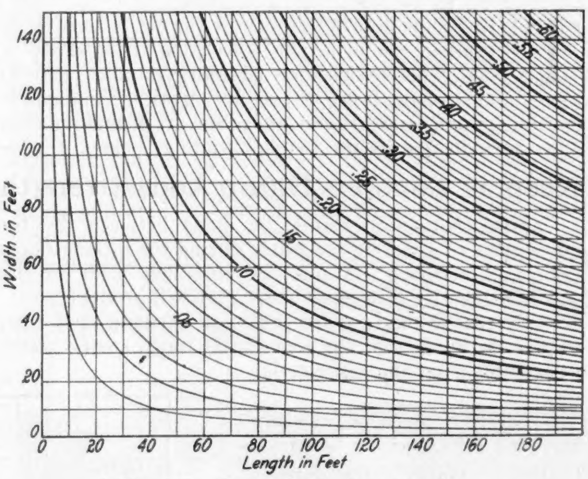
In tests conducted by the United States Bureau of Standards, thin slabs of a lean (1:6) portland cement mortar and 1:1½:2 concrete were subjected to a water pressure of 60 lb. per sq. in. This pressure is equivalent to a 138-ft. head of water. Although water penetrated through 1⅝-in. limestone slabs in periods ranging from 20 sec. to 20 min., it took 3½ hours for water to penetrate through a 2-in. slab of 1:6 mortar, while at the end of 24 hours, when the test was terminated, the 2-in. slab of 1:1½:2 concrete was still dry.

Hundreds of concrete tanks are being used for the storage of fuel oil, and these tanks are oiltight, and, of course, watertight. Concrete basements, pits, bridges, and tanks will also be watertight if proper care is taken in their construction. Experience and tests have shown that proper practice will make watertight concrete.

A Diagram For Determining Areas

By W. R. Roof
Bridge Engineer, Chicago Great Western, Chicago

NOT only the engineer but other railway officers as well, both in office and field, are confronted with problems more or less frequently in which it becomes necessary to determine the acreage of small plats of land. When one has his tables in mind, it is always possible, of course, to calculate the area, but calculations are



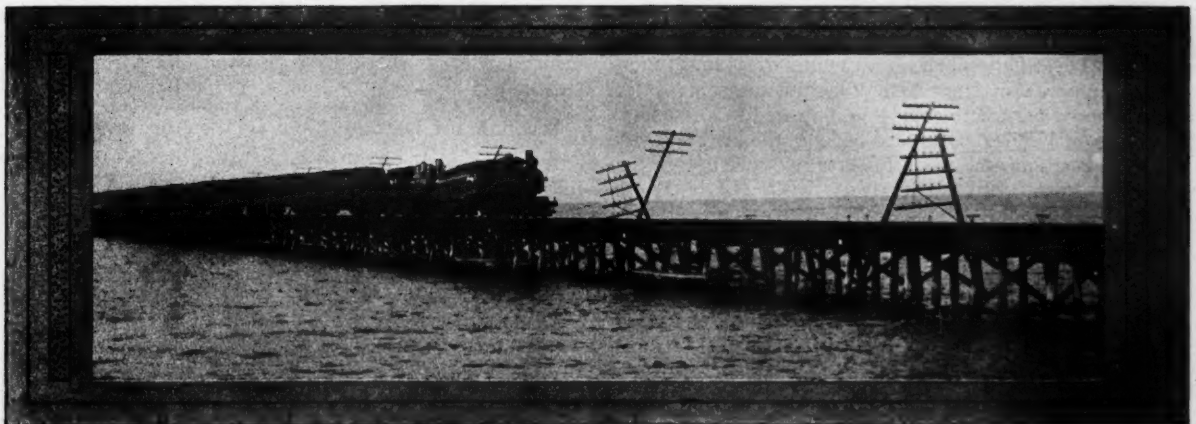
A Chart for Determining Areas in Acres

usually tedious, are conspicuously unhandy in the field and lead to a waste of time in an office where many calculations are necessary.

For handy reference, the author prepared the accompanying chart from which the acreage of any small area can be easily and accurately determined where the dimensions are given in feet.

To illustrate its use, suppose it is desired to ascertain the acreage in a rectangular piece of property 52 ft. by 161 ft. in area. By reading across on the 52 ft. line to the intersection of the 161 ft. line, it will be noted that the intersection falls about 3/10 of the distance between the 0.19 and the 0.20 curves. The result therefore is 0.193 acres. The calculated area is 0.1921 acres, giving an error in the reading of only 0.0009 acres.

The diagram can be applied to an area of any shape which can be divided into rectangles, squares or right triangles, bearing in mind that the area of the right triangle is one-half that of the same dimensioned rectangle.



Southern Railway Train on the Lake Pontchartrain Trestle.

Trestle Shows Remarkable Preservation*

Structure over Lake Pontchartrain near New Orleans requires Little Repair after 40 year's Service

By W. T. Kelleher
General Manager, Southern Creosoting Co., Slidell, La.

THE selection of a route for the New Orleans & North Eastern from Slidell, La., to New Orleans presented a difficult problem because of the necessity of crossing Lake Pontchartrain and the wide marsh surrounding it, the surface of this marsh being only about a foot above the normal level of the lake. Lake Pontchartrain is a brackish shallow body of water varying in depth from 5 to 16 ft., extending about 35 miles east and west and of a maximum width north and south of 22 miles.

From the high ground to the north shore of the lake, a distance of 2.34 miles, a trestle of untreated timber was constructed; across the lake proper, a distance of 5.82 miles, a trestle of creosoted yellow pine timber was constructed containing two steel draw spans each 250 ft. long; and along the shore south of the lake, a distance of 13.48 miles, a trestle of untreated timber was constructed, the bents being spaced 15 ft. center to center throughout the 21.64 miles of trestle. The driving of this trestle was commenced in February, 1882, and completed in September, 1883, an average of seven pile drivers being used. The drivers were equipped with drop hammers varying from 2300 to 3000 lbs. in weight and the leads used were from 26 to 54 ft. long.

Piles of Various Lengths Used

In the north approach, untreated piles from 20 to 45 ft. in length, below cut off, were driven. The total penetration varied from 15 to 30 ft. On the trestle over the lake proper, creosoted piles from 50 to 68 ft. in length, below cut off, were driven. The total penetration varied from 40 to 48 ft. according to the length of the piles and the depth of water which is from 8 to 10 ft. In the south approach untreated ties from 35 to 50 ft. in length, below cut off, were driven except at water ways entering the lake where spliced piles up to 100 ft. in length were used. The total penetration varied from 31 to 46 ft. except at the waterways where 85 to 90 ft. was obtained. The penetration for the last blow of the hammer on the piles in the trestle varied from two to nine inches with an average of about six inches for the creosoted portion but no settlement has been observed.

The filling of the north approach was undertaken in 1887 and completed in 1891. The filling of the south approach was undertaken in 1890 and completed in 1896. After the approaches had been filled, there remained the present trestle constructed of creosoted yellow pine 5.82 miles long. About 1¼ miles from each shore a draw span 250 ft. long is located to provide for traffic on the lake. The deck of the trestle is protected by a covering of gravel, the use of which was commenced in 1885 after

A View of the Deck.

fire had seriously damaged or destroyed about 325 panels to the water line.

The specifications under which the timber for this structure was treated stipulated that the timber and piles, after having been cut and trimmed to the proper length, size and shape, should be submitted to a "Contact Steam-

*Abstracted from a paper presented before the convention of the American Wood-Preservers' Association, which is reported on page 64 of this issue.

ing" inside the injection cylinder, for two or three hours, according to the size of the timbers, then to a heat not to exceed 230 deg. Fahrenheit, in a vacuum of 24 in. of mercury, for a period of from 20 to 30 hours, according to the size of the timbers. The creosote oil, heated to a temperature of about 175 deg., shall then be let in the injection vessel and forced into the wood under a pressure of 150 lbs. per square inch, until not less than 15 lbs. of oil to the cubic foot of wood has been absorbed. The oil used must contain not less than five per cent of phenic acid, and not more than 30 per cent of naphthaline.

No notching or trimming will be allowed on creosoted piles under water. The heads of all creosoted piles, after the necessary cutting and trimming has been done to receive the cap, must be saturated with hot creosote oil before putting the caps in place. Uncreosoted piles must have not less than 12 in. of heartwood at the head.

The late Colonel Nicholson, chief engineer, stated that while the specifications require 15 lbs. of oil per cubic foot, this could not always be attained owing to the timber being largely all heart, and that some of the treatment was not over 10 lbs. to 12 lbs. per cubic foot.

The office copy of the specifications bears a note by Colonel George B. Nicholson, referring to the oil specification, "Not commercially obtainable and not insisted upon." Victor Blagden, Sr., London, England, who supplied the oil used, states it was "ordinary London Oil," as then produced. Only about fifty caps had been renewed since the original construction. Seven stringers were removed in 1909 for test. The remaining stringers are the original.

Trestle in Good Condition

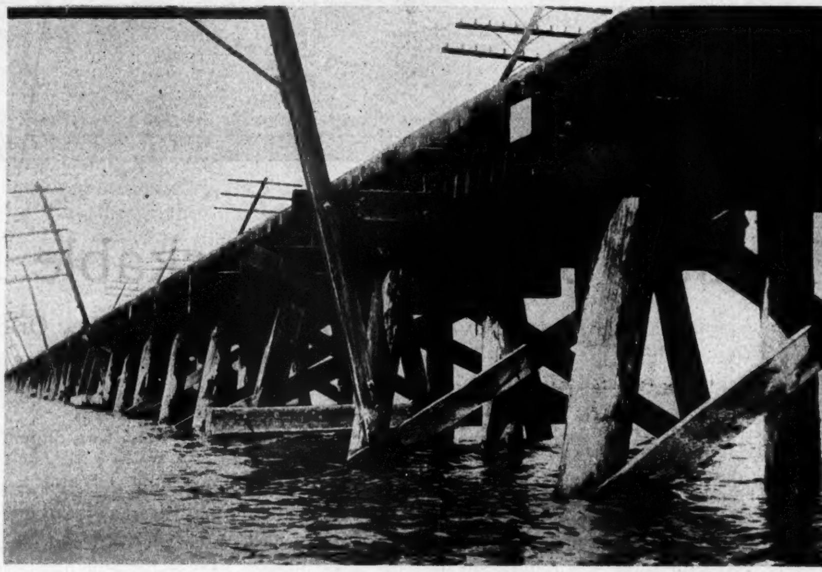
A report, made by the structural engineer, of the Interstate Commerce Commission, Valuation Division, on May 6, 1918, contains the following statement: "A very remarkable state of preservation. The original timber in good condition and apparently carefully selected and well creosoted. Estimated remaining service life of trestle 35 years." According to this estimate, the total life of the trestle is expected to be 70 years.

While data as to the action of the sphaeroma was not available until recent years, these borers were in evidence along the south end of the trestle as early as 1896. The action of the sphaeroma was confined to the extreme south end of the trestle where the fresh water from the canal mixed with the more brackish water of the lake. While no doubt the creosote oil retarded the action of the sphaeroma, some of these piles were eaten away until the diameter was reduced at least one-half.

When the operation of the N. O. & N. E. was taken over by the Southern in January, 1917, an increase in the weight of power was made from the axle loads of about 40,000 lbs. to loads of 45,000 lbs. On account of this increase in loading and the need of extra strength at the end of the trestle to withstand the effects of braking and increase of traction due to the reduced speed of trains over the trestle, it was considered advisable to drive intermediate creosoted pile bents in each panel for a distance of approximately 1400 ft. from the south end of the trestle. As a matter of fact, possibly the replacement of 30 piles would have restored that portion of the trestle to a strength obtaining four or five years before.

Main Deterioration Is Interior Rot

Aside from the limited portion of the trestle where piles have been attacked by the sphaeroma, the main deterioration of piles which has been noticed is due to interior rot, which has extended from just under the caps, down generally from 18 in. to 30 in. Many of these piles were 20 in. to 24 in. in diameter under the caps, the parts projecting beyond the caps being adzed off. Quite a percentage of the piles showed a solid ring of wood of the creosoted portion, with the interior of the pile in various stages of decay. When this condition develops beyond a proper limit, the bents are re-driven or cut off nearly to the water level. During the last few years more caps have been removed than were removed for many years before. In fact, the tops of some of the piles and a few of the caps are the only parts which have actually showed decay. In this connection, it should be borne in mind that the original construction of the trestle placed plumb piles and batter piles so as to give a wide space at the cap. Thus the stringer bearings do not load piles directly without severely straining caps. For this reason, and in view of the fact that the load on this trestle, as far as unit bending stresses and bearings are concerned, is greater than for standard trestles of the Southern railway, it has been necessary to replace a number of caps which otherwise might have been left in service. A few stringers are removed from time to time, generally due to some sort of a split condition rather than to decay. The panel length in use at this trestle is 15 ft., so that there is considerable deflection and movement in the timber under locomotive loads.



A Close View of the Piles

A considerable part of the renewal work which has been done the last two or three years and which will be continued for the next few years is demanded not so much by decay in the old timber, as it is by need of additional stiffness longitudinally of the trestle and by a decision to increase the protection against the possibility of batter posts being knocked out of place from blows by logs or boats during the storms which frequently occur.

Good Water Reduces Engine Failures and Saves Coal.

Train Operation Greatly Affected by Quality of Water

Importance of Treating Plants and Organization Graphically Demonstrated Before Western Society of Engineers

THE SYSTEMATIC manner with which some railroads handle their water supply and the remarkable and far-reaching benefits which have been obtained, especially in water treatment, were forcibly described in papers and discussions presented at a meeting of the railroad section of the Western Society of Engineers, Chicago, on January 22, on the subject of water supply for locomotive use. The first paper read was one prepared and presented by C. H. Koyl, engineer of water service, Chicago, Milwaukee & St. Paul, who treated the subject both from the standpoint of providing a continuous and economical supply of water and that of water supply improvement, dwelling especially on the location of roadside tanks and the use of water cars and giving particular attention to the results of water treatment on the Great Northern and the Chicago, Milwaukee & St. Paul. In the second paper, W. C. Smith, mechanical superintendent, Missouri Pacific, discussed the progress which has been made upon that road in treating water and summarized the results which have been obtained through scientific handling and efficient organization.

The meeting was well attended. Among those participating in the discussion were R. C. Bardwell, engineer water service, Chesapeake & Ohio; E. H. Olson, assistant engineer, Atchison, Topeka & Santa Fe; M. D. Miller, Railway Water & Coal Handling Company, Chicago; W. R. Toppan, Graver Corporation, Chicago; Cass Kennicott, consulting engineer, Chicago, and W. J. Kinney, Wayne Tank & Pump Company. The papers follow:

Economics of Water Service for Railway Locomotives

By C. H. Koyl

Engineer Water Service, Chicago, Milwaukee & St. Paul, Chicago

The average freight train costs about one dollar per minute to operate, of which the coal and the wages of the train and engine crew comprises 20 cents, the maintenance of the roadway, track and buildings 20 cents, the maintenance of locomotives and cars 40 cents, and the men employed along the line 20 cents. Knowing that the delay of a train cannot cost less than 20 cents per minute, let us consider the case of a regular water station out of water for one day, due to the breakdown of a pump or a pumping engine, the freezing of a river suction, the bursting of a pipe, or any other cause. The damage is principally in the delay to trains, and it grows with the density of traffic. It varies from place to place according to conditions, but if the lack of water necessitates one engine cutting loose and running for water and thus causes one train to lose one hour, the immediate loss is $12. If the trouble occurs where it delays ten trains one hour each, the immediate loss is $120, and if it happens on a busy line with 30 trains per day, the immediate loss is not merely $360, but probably three times that much from the tying up of traffic. The prevention of such losses depends on the eternal vigilance of competent

attendants and, at specially important places, on duplication of equipment. A study of the probable delays in case of a breakdown will determine the justifiable expenditure for extra equipment for any water station.

It Is a Mistake to Put Water Tanks in Sags

In the matter of the location of these water tanks, the mistake is sometimes made of placing the tank in a sag because the creek is there. It costs a little more to run the discharge pipe up the hill and a little more to pump the water up the hill, but the extra cost is so small compared to the continuous waste of money in starting heavy trains from the sag that there is no justification for the practice.

Occasionally the use of water cars is urged as a substitute for an expensive water plant, because on nearly all railroads there are points, mostly on branch lines, where a supply of 20,000 to 25,000 gal. of water per day is necessary because of the distance to the next station on each side, but where water is so difficult to get that an equipment to supply even 20,000 gal. per day would cost as much as a large main line water station. No one feels like authorizing such an expenditure on a branch line with only one passenger train and one freight train each way per day, and it is customary to run a water car on each freight and sometimes an extra engine tender on each passenger train between the two nearest water stations on each side, say, 50 miles apart. The cost of operating these water cars is usually considered a small matter, because at worst each of them merely displaces one car on each train, but in such a computation many items are omitted. I have found the cost of such a water car equipment for such a branch line to be as high as $800 per month in winter in the northern half of the country. In two cases I have had careful accounts kept of the cost of maintaining and operating such a set of water cars, one of which is as follows:

COST OF RUNNING WATER CARS FOR ONE YEAR

Due to Shortage of Water at Two Adjoining Water Stations on a Branch Line.

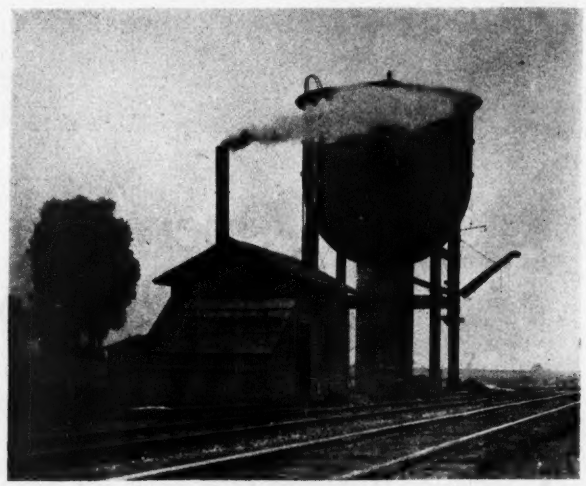
Cost of hauling water cars at 10 cents per car mile	$ 6,221.60
Cost of extra switching at terminals	390.00
Maintenance of water cars	892.89
Equipping engines with steam heat and connections	300.56
Delays from filling cars and switching en route	972.90
Coal consumed en route and in stationary boilers, heating water cars	667.80
Delays to rotary snow plow account running for water	348.81
Total cost	$ 9,794.56
3,110,800 ton miles used in hauling water cars for which revenue freight might have been hauled, had water cars not been necessary (at $2.50 per 1000 G. T. M.)	7,777.50
Grand total	$17,572.06

These figures show a cost of $800 per month, or 16 cents per water car mile, if the water car does not displace a revenue car, and nearly $1,500 per month, or 28 cents per water car mile, if the water car does displace a revenue car. In either case it costs more than the interest, depreciation and expense of operating two $20,000 water plants. This is sufficient to show something of the value of a continuous supply of locomotive water at convenient points.

The Importance of Quality Should Not Be Overlooked

But on the subject of water quality less is known, although our experience is growing rapidly. The impurities in water which trouble boilers are principally three. In the coal mine country many of the streams are polluted with sulphuric acid, which destroys the metal of the boiler; in the great central plain between the mountain ranges the waters of most rivers and practically all wells contain limestone in solution, which makes water hard and deposits scale in the boiler; in the country for a few hundred miles east of the Rockies, where rainfall is light and rivers are scarce, all well water is heavily charged with sodium salts and the sluggish streams and stagnant ponds are full of the products of decaying vegetation, sometimes acid and destructive of iron, and sometimes mere slimes which prevent the escape of steam in the boiler and cause foaming.

In 1870, long before there was a water treating plant in this country, the American Railway Master Mechanics' Association began a careful study of the greater cost of operating locomotives in a hard water district than in a soft water district, and in 1873 published the results. They found that between the average boiler of the soft water districts of New England and the average boiler of the plains there was an annual difference in the coal bill (at $2.50 per ton) of $340 per locomotive; in boiler repairs, of $360, and in boiler cleaning, of $50, or a total difference of $750 per locomotive per year. The locomotive of today evaporates about four times as much water as the locomotive of 1870, so that these figures



Water Tanks Should Not Be Located in Sags

applied today would amount to $3,000 per locomotive per year for extra washing, repairs and coal due to the use of average bad water. But the prices of coal and labor are higher now, and it is probable that the average figures today are not less than $4,500 per engine per year.

The Loss From Bad Water Is $4,000 Per Locomotive

A fairly accurate comparison which was made four years ago between engines on the west coast and on the plains showed an average difference slightly above $4,000; so that it is reasonably safe to say that on any railroad the number of engines working in average hard water, multiplied by 4,000, will give the approximate number of dollars lost yearly in the items mentioned for the want of suitable boiler water.

It is the experience also that, in addition to savings in coal and boiler repairs, there is marked improvement in economy of operation when boilers no longer leak on the road. A locomotive served with first-class water can do almost twice as much work per hour as when served with ordinary water because, with a boiler which is likely to start leaking any moment, it is not wise to take a tonnage train nor to take chances on a close meet; while with a reliable boiler the chances vanish, and the engineman takes the load and makes the time.

On the Great Northern, in 1914, a water treating plant

was built at every water station on the main line in Montana for a distance of 420 miles. Because February is the hardest month for railroading in that part of the country, a careful comparison was made between the month of February, 1915, and the same month of 1914. It happened that the two months were much alike in weather. In February, 1914, the average load per train was 1,364 gross tons, and in February, 1915, 1,881 tons, an increase of 38 per cent; and the average running time over a division (including delays) had been cut down from 14 hours to 10 hours. When that is calculated, it shows that against 100 ton-miles in 1914, the same engines hauled 193 ton-miles in 1915, or nearly double the work.

The Saving From Water Treatment Is $1,000 Per Mile of Road

I was never able to compute the exact value of the improvement in service, but my best estimate was a saving of $1,000 per mile of road per year where there was an average of 10 trains per day. That this is not too high an estimate is indicated by the following report from another road: In 1908, the El Paso & Southwestern abandoned deep well waters along 128 miles of track and supplied mountain water through a pipe line 180 miles long, built at a cost of $700,000. The report of the chief engineer states that in less than two years the pipe line was paid for by the savings on the 128 miles of railroad, which means a saving of $2,700 per mile per year. The average of the original waters along that 128 miles was worse than the average in use by the railroads of the country and the mountain water which was substituted was better than the average treated water. But the illustration proves that the estimate of $1,000 per mile per year is easily within bounds.

Some years ago the American Railway Engineering Association measured the damage done to locomotive boilers per pound of scale deposited from hard waters. It considered only repairs and fuel, taking no account of the time saved in washing or in turning engines in the roundhouse, or of the saving of time on the road. It measured the repairs and fuel of two similar engines, one fed with water seven grains per gal. hard and the other with water 21 grains hard, and the difference between them was considered to be the damage done by a water 14 grains hard. When this was divided by the number of pounds of scale deposited, it gave seven cents per pound of scale as the damage done in repairs and extra fuel. This was in 1912, when coal was taken at $2 per ton and labor rates were low. At the prices of today the corresponding cost is 13 cents per pound of scale.

Recent Results on the Chicago, Milwaukee & St. Paul

In 1920, the Chicago, Milwaukee & St. Paul began the installation of water treating plants on the tracks east, west and south of Mitchell, S. D., where the water is very bad. We had had for some years a water treating plant at Mitchell and one at Sioux City, and on the road had used all the anti-scale compound the boilers could carry; but in spite of all that had been done, the service was poor and expensive. On each engine district there were continuous boiler leaking and failures on the road every week; every boiler spent about two months in the shop every year, and averaged about $2,000 per year in heavy boiler repairs.

It is now two years since the first of the new plants were put in operation. Since then not one of the boilers using treated water exclusively has gone to the shop for boiler repairs. Because a successful effort was made to reduce the careless use of coal on the road not all the coal saving can be attributed to the treated water, and my only means of determining this amount is to deduct from the total saving a percentage equal to that on adjoining divisions.

It was noted quite early that, whereas the division of 678 miles was saving 4,000 tons of coal per month, the 130 miles which was completely treated was saving three-quarters of the total, and the 548 miles of untreated water only one-quarter of the total. It was remarked also that about half the water treated on this 130 miles of east-and-west line was taken by engines or north-and-south lines crossing it; so that the good accomplished by the treated water did not all show on the record of the 130 miles, nor even on this division, but on adjoining divisions. And since the north-and-south engines which took water also took coal, our record of coal saved on this section of road was probably not more than half of the coal saved by the water treated there.

The Largest Economies Occur In Winter

As the months went by, we found that the winter savings were far in excess of the summer savings, evidently because, with untreated water, the boiler failures and delays along the road were much worse in cold weather than in warm. As against the previous year, the freight trains carried 100 tons more load each, and there was saved an average of 60 lb. of coal per thousand gross ton-miles, which was about 25 per cent. More than half of this was saved during the winter, and out of it an allowance must be made for the general saving along the line.

There was a marked improvement in the service and in its cost; but the strike disturbances of last summer destroyed the continuity of the record, so that only a rough approximation can be made. On the 400 miles of treated water line the results were approximately uniform and the 130 miles referred to, running east from Mitchell to Sanborn, was selected for close study. The figures given are what remain after making all reasonable deductions mentioned above for the general improvement in service which followed the return of the roads to individual control, and after separating the accounts of this 130 miles from the accounts of the division as a whole.

On the 14 engines operating on this line, at least $28,000 per year is being saved in heavy repairs and at least $12,000 in running repairs, or a total of $40,000 per year in repair bills. On the same 14 engines, 600 tons of coal per month is being saved, which, at $4 per ton, amounts to $29,000 per year. This is a total of $69,000 per year saved in repairs and fuel. The other savings due entirely to treated water amount to at least $5,000 per month, or $60,000 per year, an estimate which is very conservative.

$129,000 Saved in a Single Year

This makes a yearly minimum saved of $129,000 due to the change from bad boiler water to good on a strip of road 130 miles long, where the water treating plants which effected the change cost $90,000 for construction and where the cost of treating the water is 12 cents per thousand gallons, or $7,200 per year for the amount used on this part of the line.

In addition to improved service on that 130 miles, and a reduction of $129,000 in operating expense, we have also released 3 of the 14 engines, whose construction cost was more than that of the water treating plants. And what is true on the 130 miles is true all over the treated water district. Water treating plants repay more than their construction costs in a few weeks by the release of engines and by increasing the speed and value of cars, and thereafter continue their good work by maintaining the efficiency of the rolling stock that is left in service.

Missouri Pacific Secures Excellent Results

By W. C. Smith

Mechanical Superintendent, Missouri Pacific, St. Louis, Mo.

The experience of the past year has demonstrated clearly and beyond question the great advantage of giving careful attention to the quality of locomotive boiler water supply. It is recognized that the question of proper water supply is an individual problem in each instance. The Missouri Pacific, after experience with many varieties of proprietary compounds and also soda ash, adopted a constructive program for the improvement of the quality of its water supplies by the elimination of the largest possible amount of impurities before turning the water into its locomotives. These experiences are not intended as representing recommendations for universal practice, but are submitted as information and may prove of benefit in suggesting a method which has effected large economies and materially assisted in the improvement of locomotive operation and maintenance.

The Missouri Pacific system operates over approximately 7,500 miles of railroad. It taps nine states, extending from the Mississippi west through the plains of western Kansas to the Rocky mountains and from the Missouri river south through the Ozarks of Arkansas and the bayous of Louisiana. The characteristics of the water supplies sources vary from the best to among the worst in the country. Water supply problems include the handling of the coal mine waters in Illinois, the muddy waters of the Missouri, the gyp and alkali waters of the Kansas plains, the salt waters from oil fields and the soft soda waters from southern deep wells. With such variety in the quality of water supplies the marked difference in effect upon engine performance and operation was noticed early. Trouble from scale with consequent leaking and short life of flues and fire boxes on bad water districts was a problem of the first importance. Various compounds and soda ash were tried out as internal treatments, but in most cases they resulted in an increase in foaming and involved the road in such heavy expense for a careful follow-up system that it was decided to place reliance on more careful and reliable methods.

There Are 81 Plants in Operation

Complete water softening plants were first installed in 1905. The terminals at Little Rock, Ark., Kansas City, Mo., Hoisington, Kan., and Wichita, and Pueblo, Colo., were equipped and a number of intermediate stations between Poplar Bluff, Mo., and St. Louis, and Bush, Ill.; also between Kansas City and Pueblo, about 32 stations in all. A summary for the year 1909 developed the following: Water treated, 312,234,000 gal.; scale removed, 591,000 lb. Compared to 1905, there was a 44.7 per cent reduction in engine failures due to leaky flues, etc., and also a reduction of 33.3 per cent in boiler maintenance and consequent increase in net tons handled.

In view of these results and the large return on the investment, an appropriation was made for 18 additional plants to be installed in the bad water district west of Kansas City. Up to this time, the entire supervision for all plants had been centered at St. Louis, but it was found that the distance severely interfered with the obtaining of efficient and regular results, so in 1910 traveling chemists with small laboratories were located at Kansas City and Little Rock, these being central and convenient headquarters. This arrangement worked out very well and excellent results were obtained.

In 1917, eight additional plants were installed on the district between Hoisington and Pueblo, which completed the treating equipment at all water stations on this territory. The results obtained were so definite and satisfactory that the district from Kansas City to Omaha was similarly equipped in 1919 and 1920. Since that year the development has been continuing steadily, until there are now 81 softening plants (including 9 soda ash plants) in service and 6 additional plants are under construction. Of the total of 81 softening plants in service, 36 are of the intermittent type and 45 of the continuous type. Hydrated lime and soda ash are used for the removal of objectionable matter in supplies, except at the nine soda ash plants, where treatment consists only in the removal of the incrusting sulphates.

The cost of chemicals used in treatment varies from 1.2 to 13.3 cents per thousand gallons, depending on the quality of the raw water; an average cost is approximately four cents. The total average cost of treatment, including cost of chemicals, operation of plant, depreciation and supervision, is approximately nine cents per thousand gallons. Installation costs for plants will vary over a considerable range, from $75 for the conversion of a roadside tank into a soda ash plant, to $22,000—the cost of some of the patented softening plants now on the market. An average cost for installations in use on this system is approximately $4,000.

The Estimated Net Saving Is $500,000 Per Year

With the installation of six or eight more plants at some of the points of greatest consumption, it is expected that the quality of water on the Missouri Pacific will be very well in hand. Statistics for 1922 will show that there are 387 water stations in service. Approximately 7,000,000,000 gal. were supplied, of which 6,000,000,000 gal. were used for steam purposes. Of this amount, 2,400,000,000 was softened and approximately 5,000,000 lb. of scale removed which would otherwise have gone into the boilers, causing scale and its attendant troubles. It is estimated that a saving of 70,000 tons of coal was effected in 1922 by keeping this insulating coating from forming on the tubes and sheets. The saving in boiler maintenance, engine time and in reduced engine failures has also been very large. It is estimated that the net saving, after subtracting the cost of treatment, will be in the neighborhood of $500,000, although the investment in treating facilities does not exceed $300,000. The intangible benefits, such as the improved morale of the forces and the greater reliability of the power, are factors which have also benefited greatly by these facilities, but cannot be reduced to dollars and cents.

The following may be of interest, as being largely attributable to water softening:

	Increased life flues and fire boxes	Reduction in boiler work	Reduction in engine failures due to boiler troubles
Little Rock district	150 per cent	45 per cent	40 per cent
Kansas City district	200 per cent	55 per cent	30 per cent
Wichita district	300 per cent	75 per cent	85 per cent
Hoisington district	300 per cent	65 per cent	70 per cent
Falls City district	100 per cent	40 per cent	30 per cent

An interesting feature was brought out on our Colorado division, which runs from Hoisington, Kan., to Pueblo, Colo., 338 miles, and is divided into two engine districts at Horace. Before water treatment it was necessary to take out a "V" of flues every four to six months and clean out the scale, and to renew the entire set after 10 or 12 months' service. The flues in locomotive boilers are now run from 30 to 42 months. Instead of ¼-in. scale on the flues when they are removed, there is less than $\frac{1}{16}$-in. scale. An engine running on one district could not work on another without several weeks of bad leaky troubles, but engines are now operated through from Hoisington to Pueblo without any difficulty at all.

On the district between Kansas City and Omaha we formerly experienced considerable trouble with leaky staybolts, making it necessary to hold an engine for staybolt inspection and repairs about three days per month. Since the complete treatment of water supplies was put into effect we have practically eliminated the leaky staybolts and engines can be returned to service in less time.

As an example of water treating results for stationary boilers at our Sedalia, Mo., power plant, where water is treated for five Babcock and Wilcox double-deck water tube boilers of 275 hp. each, about 650 of the 840 four-inch tubes were in service 12 years, using treated water. The raw water here contains about 20 grains per gallon of incrusting matter, or nearly three pounds per 1,000 gal., and with its use untreated, tube failures were frequent and the scale heavy and very hard.

Many such individual instances can be cited, but it is probable that any other railroad which has given careful attention to its water problems can do likewise. In fact, although we cannot say our scale troubles have been eliminated, they have been materially reduced. Also, although engine failures from leaking have not been entirely eliminated, it is a fact that they are becoming very rare.

An Efficient Organization Is Indispensable

A factor which must be given attention in the correction of water supplies is the matter of organization and supervision. The best and most expensive apparatus will not give results unless operated correctly and regularly. If a water treating plant is not run properly it is worse than useless. Not only is the investment a loss, but expected results are not secured and the entire plan is discredited. Only by careful and systematic organization and by placing definite responsibility can good results be secured. The methods which have been established and worked out for taking care of these facilities on the Missouri Pacific are as follows:

The water supply supervision is centered in the engineering department, an engineer of water service being placed in direct charge. Small laboratories in charge of traveling chemists have been installed at Little Rock, Kansas City and Osawatomie, Kan. Samples of both raw and treated water are sent from each treating plant to the designated laboratory on each Wednesday and Saturday, where tests are made promptly and reports are made to all concerned. Any indication of unfavorable tests results in an inspection of the plant on the ground. The treatments are governed largely by the inspection of conditions in boilers and the chemical tests are made to assure water being maintained in a condition found to be most favorable. The traveling chemists, in the course of their inspection, consult freely with operating officers, general and division master mechanics, roundhouse and boiler foremen and others interested, and any complaint is taken care of without delay. The engineer of water service and general boiler inspector co-operate with each other and all concerned. In this manner water troubles are adjusted and minimized.

A point which is always brought up in a discussion of water treatment is the question of foaming. It is a fact that as a general rule when a water softening plant is put in service considerable foaming complaint results. This is also more or less true when an engine is transferred from one district with one quality of water to another with different water. In most cases this trouble stops after a few weeks. We have had some foaming trouble on the Missouri Pacific, but with the use of an anti-foaming preparation, which is essentially a weak acid emulsion of castor oil made up by our chemical department, trouble of this sort has been kept at a minimum.

The chief difficulty encountered with boiler waters at present is pitting and corrosion. The solution of this problem is still under study to determine the cause more exactly, but in this connection it can be said that while our present system of treatment has not eliminated this trouble, the improvement in conditions has been very marked.

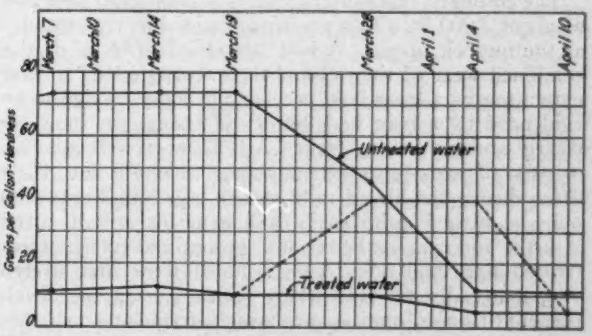
In summarizing, permit me to emphasize again the importance of careful and conscientious study of water supply problems by a specially trained organization. This, together with close co-operation between the water service, operating and mechanical departments, will insure remarkable and satisfactory results and economies. Our experiences on the Missouri Pacific, where treating plants have been installed and properly supervised, have proven conclusively that these results can be accomplished.

Discussion

A general discussion followed the presentation of these papers, during which M. D. Miller (Railway Water & Coal Handling Company), under whose direction the first water treating plants on the Missouri Pacific were built, responded to a request from the chair with the statement, by way of supplementing the paper of W. C. Smith, that during the year prior to the installation of the first three water treating plants, the records showed that a total of 186 engines operating over the district suffered an average of 21 failures a day of a nature to require the engines giving up their trains. Thirty days after completion of the three plants the records showed that failures had decreased 97 per cent and that a saving of $10,000 had resulted in boilermakers' wages alone.

Water Treatment on the Santa Fe

Adding still further to the general information on the subject, E. H. Olson, assistant engineer, Atchison, Topeka & Santa Fe, stated that on the 11,700 miles of line operated by this road there are 600 water stations, of which 100 are equipped with treating facilities. These treating plants are located in all the states in which the Santa Fe operates excepting in Nebraska and Nevada. The total amount of water treated annually is about six billion gallons, from which 25 million pounds of incrustants are removed. The smallest treating plants have a yearly output of 1,800,000 gal., or about 5,000 gal. per



Variation in the Condition of Raw and Treated Water at a Reservoir Station

day. The largest plant has a yearly output of 500,000.000 gal., or over 1,000,300 gal. per day, and from which there are removed 2,500,000 lb. of incrustants per year. The range of water treated runs from 15 grains per gal. to 120 grains.

The importance of an efficient organization in getting results from water treatment was emphasized by R. C. Bardwell, superintendent of water service, Chesapeake &

Ohio, and was further discussed by D. A. Steel, *Railway Engineering and Maintenance,* who presented charts compiled from actual water treating records to show graphically the desirability of controlling the operation of treating plants by field inspections made on the ground by men constantly in touch with local conditions. The accompanying chart illustrates the situation which was represented as often arising in the case of reservoir supplies due to their sudden filling by melted snows in the drainage area. The upper line represents the hardness of the untreated and the lower line that of the treated water as determined by field tests made on the days of the month indicated by circles. In a period of about two weeks the untreated water is shown to have changed from 74 grains per gal. of incrusting solids to 11 grains, during which the treated water was kept well within control. Mr. Steel attributed this to the fact that the tests were made in the field and character of treatment correspondingly changed by a man familiar enough with the local conditions to be on the lookout for the changes which took place. If no supervision of this character had been provided in this instance, it was pointed out that the untreated water, by reason of excessive chemicals used, would have changed in hardness somewhat as indicated by the broken line and would probably have resulted in troubles more serious than those arising from the use of untreated water in its worst condition. Aside from his comments on the importance of vigilance in treating plant operation, Mr. Steel also emphasized the bearing which water treatment had upon the operation of trains during the recent strike, as well as its value in permitting railroads to carry out their new developed programs of running locomotives over longer districts.

During the discussion mention was also made of the advantages claimed for the zeolitic method of softening water for locomotive use and of the desirability of adopting a more easily comprehended system of reporting the results of water analysis, Cass Kennicott, consulting engineer, claiming that the method of reporting analyses in terms of grains per gallon or in parts per hundred thousand should be supplanted altogether by that of reporting the results of analyses in pounds per thousand gallons.

Tight Bolts Prolong Life of Rail

By B. M. Cheney

General Inspector of Permanent Way and Structures; Chicago, Burlington & Quincy, Chicago

In the "What's the Answer" section of the July issue of the *Railway Maintenance Engineer,* the question was asked "What is the purpose of a nutlock?" A number of answers were published in the August issue, which may be summarized as follows: (1) To eliminate loose bolts; (2) To take up slack in the joint when the bolt stretches; (3) To prevent nuts from turning back; (4) To preserve sufficient threads on the bolt to permit further tightening; (5) To provide leeway so that nuts can be loosened in hot weather to allow expansion and contraction of the rail; (6) To reduce vibration or friction.

Assuming that it was intended that this question should bring out the functions that a nutlock really performs, the writer desires to take exception to the first two answers given above.

The ordinary coil nutlock exerts a maximum pressure of about 3,000 lb. This pressure diminishes very rapidly as the nutlock opens. A bolt stretch of 1/32 in. or the combined wear of the rail and the two angle bars to that extent means a loose bolt, perhaps not loose enough to be evidenced by a boot kick but loose enough to show up clearly under a passing train. A 1/32 in. stretch of a bolt or wear of parts represents a quarter turn of a nut. How often during the life of rail in track is it found that nuts may be turned quite easily a quarter or a half turn? Ask the foreman, or better still, go out and try it. Heat treated bars and bolts have reduced wear and stretch very materially but even where both are used, the development of loose joints is surprisingly frequent.

The writer has seen heat treated joints equipped with heat treated bolts wear in two years to an extent that made it necessary to replace them "out of face" with new bars and this in track where the life of rail ranges from six to eight years. In hundreds of miles of track where traffic is lighter, it has been found necessary to change joints once and sometimes twice during the life of the rail.

This was not a new condition, for inquiry has developed the fact that it has existed for years but has come to be considered a necessary evil and year after year many miles of battered rail have been renewed which might have been carried in track 25 per cent to 50 per cent longer if the joints had been kept tight and the bars changed when they had become so worn that it was impossible to keep them tight.

The Trouble Is General

This "discovery" and the expensive treatment required to correct it naturally raised the question, "Is this a local condition or are other roads suffering from it as well?" An inquiry, plus some trips over the tracks of a dozen other roads, very quickly proved that it is a common evil.

This condition first came to the attention of the writer in 1915 and since that time every effort has been made to find a remedy. It was easy enough to say, "The remedy is simple—keep your bolts tight," but even though we might be allowed without question, the necessary labor to do this, the question remained as to whether the addition to our forces of the necessary labor was the most economical way to handle it.

These seemed to be but one alternative, viz: a joint fastening that would take up the wear in the joint automatically. Approaching the problem from this angle, T. E. Calvert, formerly chief engineer of the Burlington, began a series of tests culminating in a flat steel spring covering two bolts, the pressure exerted on each bolt ranging from 8,000 to 12,000 lb. It was found that this spring maintained a pressure in excess of 3,000 lb., or that of the ordinary coil nutlock, through a distance of 1/16 to 3/32 in. The first installation indicated very clearly that the wear of joints was being retarded very materially while the labor of tightening bolts was reduced to an extent that indicated a real saving in maintenance.

This spring has gradually undergone a number of changes—chiefly with the idea of increasing the pressure until, as it stands today, a pressure of 18,000 to 26,000 lb. is exerted on each bolt when the spring is compressed. The results, even a few months after installation, are so evident that in making estimates as to the saving the device may effect, one is apt to be over sanguine.

Three years ago the joints were renewed and springs

applied on a stretch of 100-lb. rail listed for relay. This rail is still in such good condition that it will not be included in the relay program for 1923 and the wear of bars has been negligible. The usual life of rail in that place is six years, while if the rail is relaid in 1923, it will have given ten years' service.

As stated above, the remedy for bad joints lies in keeping them tight, for a loose joint invites wear of the bar, wear of that part of the rail with which the bar has contact and wear or stretch of the bolts. It would be difficult to make an accurate estimate in money of the saving that tight joints would effect but it would seem that we may expect benefits as follows:

(1). Life of rail will be lengthened 20 per cent to 25 per cent. Battered rail ends are caused chiefly by loose joints.

(2). Angle bars will last as long as the rail on first installation, doing away with the heavy expense of changing bars. Angle bars wear out rapidly when joints are loose.

(3). Labor saving by reason of less bolt tightening.

(4). Joint ties will give longer service under tight joints. J. H. Waterman, superintendent of timber preservation on the Burlington, in his last annual report on experimental ties, said:

"I have been watching very closely ties under our rail joints the past few years, and I find that they wear out very much faster than the other ties in the same track. I have been trying to locate the cause and I think I have it—loose bolts. Show me a joint where the bolts are tight and kept tight and you have very little trouble with the ties wearing mechanically under the joint. Show me a joint where the bolts are loose and I will show you a joint where the ties are more or less mechanically worn and usually very badly mechanically worn."

(5). Joints will require less maintenance if bolts are always tight.

(6). Saving in bolts. Most of our bolt renewals are due to the fact that the tightest bolt bears most of the burden of impact, resulting in its being stretched beyond the elastic limit. The springs act as a compensator and distribute the load more evenly to the four bolts.

The saving in money might be estimated about as follows:

	Saving per Track Mile
One application of bars saved. The net cost of changing 90-lb. bars amounts to about $720 per track mile, and assuming the life of rail as 12 years, the annual saving per track mile would be............	$ 60
One tightening of bolts saved........................	20
Saving in ties, estimating an increased life of two years for joint ties..............................	140
Saving in joint maintenance (surfacing)............	20
Saving in bolts. More even distribution of load and tight joints will reduce bolt renewals.............	5
	$245

It will be noted that the estimate given above does not take into consideration the lengthened life of rail. That saving would vary on different roads and on different stretches of track on the same road, but it seems probable that from 25 per cent to 50 per cent increased life might be obtained.

Another item in the cost of joint maintenance that deserves special attention is that of turning nuts on and off. Bolt specifications usually provide that nuts shall have a hand free fit on the bolt of two to six turns and wrench tight the balance of the screw length. This means that after the nut has been started by hand the tightening must be finished, a quarter of a turn at a time, with a track wrench.

The importance of this item of labor may be realized by watching any track gang removing old or installing new bolts. A time study recently made by the writer indicated that to remove the four bolts from joints that had been in track only three years required from 12 to 20 minutes while the installation of new well-oiled bolts required only a little less time. The bolts in question had been made to a specification providing for from two to six free turns, the balance being wrench tight. Bolts that were free turn all the way were removed and applied in one-fourth to one-sixth the time. Thus the saving in labor that might be effected through the use of free turn bolts would probably amount to at least $15 per mile for removal and $10 per mile for installation or $25 per mile where rail is being relaid.

The wide range afforded by the high pressure springs suggested the idea that perhaps free turn bolts might be used safely with them. A dozen such bolts were, therefore, obtained and have now been in track six months with no evidence of back turn. This seemed to justify a larger test and accordingly a thousand free turn bolts were obtained and installed in June of this year. They have all been marked and will be inspected at frequent intervals to determine to what extent, if any, the nuts turn backward. After two months' service, the nuts are still in the same position as when tightened in June.

Taking Care of Valves*

THE AVERAGE employee probably does not realize the large number of globe valves required annually on a railway system. During the years 1920 and 1921 the Illinois Central and the Yazoo & Mississippi Valley purchased 22,359 globe valves at a cost of $80,083.11, an average of 11,179 globe valves per year, or an annual cost of $40,041.55. This means that 37 new globe valves were used each working day, at an average daily cost of $133.47. There are not many items used on a railroad that are subjected to more abuse through improper handling than valves nor are there many devices in use of more importance than valves so far as waste is concerned.

There are any number of ways in which a valve may be damaged. For example, the careless closing of valves results in more leakage and waste than any other one thing, yet it is a common practice to close valves against their seats with sufficient pressure to either buckle the seat or strip the stem. Some valve operators will use the same force in closing a ⅜-in. valve as in closing a 3-in. valve. Due consideration should always be given to the size of the valve, as it does not require any great effort to strip or twist off the stem of a small valve.

Another bad practice is the use of wrenches on the wheels of valves. This invariably results in breaking the hand wheel or twisting off the stem. Failure to keep valve stems properly packed not only causes much waste and an unsightly appearance, but often results in bursting the packing gland through trying to pull up the packing enough to make a tight joint. Failure to close valves firmly results in leakage that causes a wire-drawn seat and ultimately requires a new valve. Many valves are badly damaged before they are put in service through using a pipe wrench to screw them in place or by not using oil on the threads, with the result that the valve is distorted through excessive force required to make the joint. Multiple seat valves are damaged by allowing the seats in the head or the plate to become loose or by inserting new plates improperly. Closing a steam valve against the seat when cold invariably results in damage to the seat or stem when the valve becomes heated.

If proper consideration is given the question of valves very marked economies may be effected.

*From the Illinois Central Magazine.

The Convention Party at New Orleans.

Wood Preservers Discuss Railroad Problems at New Orleans

Shortage of Creosote, and Treatment of Car Materials, Water Tanks and Fence Posts Principal Topics Considered

THE NINETEENTH annual convention of the American Wood Preservers' Association, which was held at the St. Charles Hotel, New Orleans, on January 23-25, was characterized by a program of special interest to railway men. More than the usual amount of attention was devoted to the consideration of subjects of primary interest to the roads, including the treatment of water tanks, fence posts, car material and poles. Special attention was given to the shortage of creosote oil which is now becoming acute and a committee of railway and government officers was appointed to consider the possibility of mixing crude oil with creosote.

W. H. Grady (superintendent of plants, American Creosoting Company, Louisville, Ky.), who succeeded to the presidency of the association on the death of Frank J. Angier (superintendent of timber preservation, B. & O.), last March, presided.

The report of S. D. Cooper (assistant superintendent of timber preservation, A. T. & S. F., Topeka, Kan.), secretary-treasurer, showed a total membership of 522, a gain of 113 during the year. The financies of the society were in an equally satisfactory condition.

Creosoted Water Tanks

By C. R. Knowles

Superintendent Water Service, Illinois Central.

There are approximately 20,000 tanks in service on the railroads of the United States and from the best figures available, the average life is about thirty years. This means that 667 tanks are required annually for renewals alone; in addition approximately 200 tanks are required on new lines and for extensions to existing water facilities, or a total of 867 tanks. Assuming that the new tanks are all A. R. E. A. standard 20 ft. by 30 ft. tanks on 20-ft. wooden towers they represent over 18,000,000 board feet of lumber used annually for the construction of water tanks.

The increasing scarcity of suitable timber for the construction of wooden water tanks, together with the increased cost of such timber, has resulted in a number of railroads constructing creosoted tanks, this type of tank having been adopted on at least five railroads up to the present time. Although many different timbers are commonly used untreated few are available in suitable sizes and lengths to be used in the construction of large tanks such as railway water tanks, and when the maximum life of the timber is given due consideration the list may possibly be reduced to only two timbers, cypress and redwood. The great demand for these timbers—especially in tank grade—has been such that their price advanced rapidly during the war and has since maintained a high level. In addition to this suitable lengths and sizes of clear heart material are difficult to obtain. The war also had its effect on the cost of steel and concrete tanks, and cresoted timber appears to be one solution of the problem of construction of economical and serviceable water tanks.

There are approximately 100 creosoted tanks in service at this time, 90 of these tanks being on the Illinois Central and the Big Four.

The creosoted tank has an advantage over the untreated wooden tank in the fact that any timber that will take treatment can be used, thus making the cheaper timbers available for tank construction. The cost of treatment should be considerably less than the difference in the cost of higher priced timber with the result that the completed structure should show a much lower first cost than the untreated tank while the life of the creosoted tank will equal if not exceed that of the best untreated wood. There is also a great advantage in the creosoted tank from a maintenance standpoint by reason of the fact that the treatment makes all staves and bottom plank equally resistant to decay. This is also true of the tower, roof and frost box. If the entire structure is treated, all material should have a fairly uniform life and replacement of parts made necessary by decay will be reduced to a mimimum.

In the tanks constructed on the Illinois Central the presence of creosote oil in the water has been so slight as to be hardly noticeable and there has been no detrimental effect upon the water. While no statistics are available as to the liability of the creosoted tank as a fire risk, it is generally conceded that creosoted timber does not offer as great a hazard from fire as untreated timber, especially in heavy mill construction such as a tank tower.

The Convention Party at New Orleans.

Creosoted tanks are being built by the Illinois Central in two standard sizes as adopted by the American Railway Engineering Association—50,000-gal. capacity with a 16-ft. stave and 24-ft. bottom, and 100,000-gal. capacity with a 20-ft. stave and a 30-ft. bottom. (The 20 ft. stave is also used with the 24-ft. bottom for the construction of water softening tanks.)

For reasons of economy wooden towers should not be used for tanks requiring an elevation of more than 40 ft. as steel is more desirable and will show a lower first cost if properly designed, and in all probability a lower cost of maintenance. Towers for railroad water tanks rarely exceed 30 ft. in height and the majority are 20 ft. or less in height. Creosoted timber is admirably adapted to this purpose. The Illinois Central, as previously stated, has been constructing creosoted tank towers for over 20 years and now have about 100 in use. The first towers erected are still in service and are apparently good for another 20 years. The maintenance on this type of tower is almost negligible as they do not require painting and framing before treatment making the life of all parts practically uniform.

A very important feature in the construction of creosoted tanks on the Illinois Central is that all timber more than 1 in. in thickness is framed before treatment, to secure the maximum life from the treated timber. The work of framing and treating is done by company forces at the Grenada, Mississippi, creosoting plant. This plant is equipped with machinery for the ordinary framing of bridge timber, etc., but we do not have any special machinery for framing the tanks. The staves and bottom plank are surfaced to size and the staves are given the proper bevel in a planer; the croze is cut in the stave by machine and the bottom is scribed and framed by hand The work of framing the tank and tower before treatment is given such careful attention at the plant that it is rarely necessary to bore a hole in the treated timber during the field erection of the tank, and no difficulty whatever is experienced in making the tank water tight. Framing at the plant before treatment shows considerable economy over the cost of framing in the field.

When the first tanks were constructed on the Illinois Central a great deal of consideration was given to the specification covering the timber used in the staves and bottom plank with a view of getting a thorough penetration of the wood with as little oil as was consistent, as at that time there was some uncertainty as to the effect of the creosote on the water. The decision was to specify that all timber used in the tub should be as near as possible all sap with the result that the staves used in the construction of the first 18 or 20 tanks creosoted were all sapwood and the bottom planks were all sap on one face, and as far as we could judge, the heart was not over one inch thick on any bottom plank.

The Rueping process was used in the treatment of these tanks, 5 to 6 lbs. of oil being used, but on account of the difficulty encountered in getting all sap staves the timber specifications were modified to include heart wood. The treatment was also changed to the full cell process using 15 to 16 lbs. of oil in order to get better penetration into the heart wood. While we do not get complete penetration on all staves and bottom plank, using both heart and sap wood, we do secure full treatment on 75 per cent of the timber and the untreated portion in the center does not exceed one inch at any time. The excellent results we get in the treatment of these tanks is undoubtedly due in no small part to the thorough seasoning of the timber before framing and treatment. During the dry summer months the timber is thoroughly seasoned in from 50 to 60 days and the staves and bottom plank are as dry as a bone when treated. With ordinary care in the selection, framing and treatment of timber a conservative estimate of the life to be expected of a creosoted tank is a minimum life of thirty years and maximum life of forty years or more.

The future of the creosoted tank rests with the commercial creosoting plant, for while individual railroads will no doubt continue to build them, they will not come into general use until they are manufactured and sold commercially. Comparatively few railroads are prepared to frame and treat their own tanks and as long as it is necessary to purchase the tank from a tank works, ship to the creosoting plant and reship to the job, with the incidental delay and expense, the development of the creosoted tank is going to be slow and the majority of the railroads will continue to build untreated wooden tanks or adopt steel and concrete tanks.

Report on Corrosion of Fastenings

In order to obtain the latest information on this subject a questionnaire was sent to 47 leading railroads from whom 43 replies were received. Of these companies, 17 do not use zinc chloride. Of the 26 companies who use zinc chloride in the treatment of ties 13 have noted no appreciable corrosion of track spikes used in ties treated with zinc chloride, 3 have noted some corrosion but report equal deterioration with untreated ties, 4 have noted corrosion but report the same effect from brine drip or indicate that the effect is found only where signal systems are in use, 1 has noted corrosion mainly where coal is used for fuel and particularly where

there is cinder filling and 5 report corrosive action in zinc treated ties without similar effect in untreated wood and do not mention any particular conditions of service which might be considered contributing causes.

While the information available shows that there are some cases where the zinc chloride treatment of ties seems to hasten corrosion, there are equally authentic cases where under practically the same service conditions no appreciable corrosion has occurred. Cases are also reported where as much corrosion has occurred with spikes in untreated ties. The committee concluded therefore that in general the situation is not serious and that where excessive corrosion is noted it would be well to look for causes other than the zinc chloride because a complete explanation may thus be found.

A. L. Heim (Forest Products Laboratory), Chairman; G. M. Davidson (C. & N. W.) A. R. Joyce (Joyce-Watkins Co.).

Report of Committee on Inspection

Ground upon which material is piled for seasoning should be preferably of cinders. When not possible to obtain this condition a sandy loam is essential. Drainage should be good. Premises should be void of vegetation, if this is not practicable it should be kept cut close to the ground—all decayed material or anything that tends to produce infection in material should be removed from premises. Material should not be piled in shade of trees or buildings. It should be piled on treated stringers or other rot resisting material.

In the case of ties it is considered good practice to lay one layer of stringers, perferably five tie lengths deep from track. The "one by nine" or "Alternate layer method" of piling ties for seasoning has proved very satisfactory by test and experience. This method affords the proper air space in pile, as well as drainage from rain water, and contact points are reduced to a minimum.

Piles of ties should have at least three feet of alley space on all sides. Distance from track will be governed by yard layout. It is considered good practice to maintain a regular number of ties in each layer. Ties are usually piled to a height governed by local conditions, the maximum height is usually twenty layers.

Material seasoned in the western part of the country or states of more or less arid climatic conditions, is piled closer to avoid excessive checking and case hardening, and in localities where the humidity is very high the greater part of the time the ties are sometimes piled "one by seven" in order to assure a more satisfactory degree of seasoning.

The determination of the extent of seasoning is usually done by what might be termed a visual method. An inspector's ability to determine the extent of seasoning is acquired by practical experience visually. The moisture content and constant weight methods are also used to arrive at more definite conclusions. Each plant should endeavor to have complete records of tests on seasoning. Such records should include complete weather conditions at all times, moisture determinations on ties cut from different localities, various places on the yard, ties cut at various seasons, and several positions in the pile. Constant weight tests on ties as above should also be included in the records. Tests from which these records are made should cover a period of from one to two years.

Material should be loaded on trams in a manner which will allow all surfaces to come in contact with the preservative. This applies especially to sawn material. Trams should be well loaded at all times.

The proper procedure to be followed in the treatment of material is governed by the character of material, susceptibility to treatment, sap or heartwood content, extent of seasoning, air or artificially seasoned, condition of storage yard, method of piling, amount of humidity and rainfall, as well as range of temperature and altitude.

Softwood material is air seasoned from 3 to 5 months in territories of general high temperature, and 4 to 8 month in territories of general low temperature. Hardwood material requires air seasoning from 6 to 12 months in territory of general high temperature and from 8 to 12 months in territory of general low temperature. In the case of both softwood and hardwood material, conditions vary as enumerated in first paragraph.

Material should be tested for penetration. If possible this test should not be made until material has become dry after treatment. Samples can be taken from material by means of an increment borer or saw. Tests can be made for penetration of zinc chloride by what is known as the visual method

J. R. Keig (Kirby Lumber Co.), Chairman.

The Shortage of Creosote

The shortage of creosote received serious consideration and much thought was given to the necessity of developing some substitute for oil. Three suggestions were offered as follows:

Zinc Chloride Advocated

E. B. Fulks, president of the Arkansas Preservative Company, St. Louis, Mo., presented a brief paper in which he pointed out that a study of the tie statistics from 1909 to 1921 shows that during the next few years the railways will require at least 110,000,000 ties per annum. The percentage of ties which were treated during this period has increased from 17 per cent in 1909 to over 50 per cent in 1921, the most rapid increase in percentage being during the past six years, which indicates that from now on over half the ties used will be treated and that during the next few years the railways will require from 60,000,000 to 75,000,000 treated ties per annum.

For 1923 the maximum amount of oil that possibly can be expected to be available will be 80,000,000 gal. Allowing half of this for treating material other than ties leaves at most 40,000,000 gal. or enough for treating less than 20,000,000 ties. The solution lies in a more rational use of the available supply of creosote and a more extensive use of zinc chloride.

Low Temperature Tars

Roland P. Soule of the Combustion Utilities Corporation, New York City, presented the merits of low temperature tars as a preservative. These tars are a by-product of the production of industrial gas which are becoming available in rapidly increasing quantities. They appear to have the same penetration and absorption as ordinary creosote. Their resistance to evaporation and leaching are greater, their toxicity is considerably higher and they are less corrosive to steel and brass than the coke oven and gas oven products.

Crude Oil—Creosote Mixtures

C. M. Taylor, supt. of timber preservation, P. & R., described various experiments have been under way for many years with mixtures of crude oil and creosote. Results are becoming available which give promise of success. In order to ascertain the merits of this proposal the following committee was appointed to undertake an investigation and to report as soon as possible: R. S.

Belcher (A. T. & S. F.), L. J. Reiser (C. R. I. & P.), F. D. Mattos (S. P.), H. R. Condon (Penna.), Mr. Stone (N. P.), J. L. Vaughan (N. & W.), F. S. Shinn (C. B. & Q.), O. C. Steinmayer (St. L.-S. F.), E. Bateman (U. S. Forest Products Laboratory), Galen Wood (P. & R.), R. J. Angier (B. & O.).

Report on the Preservative Treatment of Car Material

Wood is used more extensively in car construction than any other material. Eighty-two per cent of all timber removed from cars is removed on account of decay.

The following material can be treated by any process desired without contamination of lading: Sills for stock, flat, coal, grain and refrigerator cars; end posts for stock, coal, grain and refrigerator cars; flooring for stock, flat and coal cars; sub-flooring for refrigerator cars, posts for stock cars, roof boards for refrigerator cars and roofing for stock cars.

The average life of these is as given:

Stock car decking is	2 to 6 years	Flat car decking	6 to 8 years
Stock car sills	5 to 8 years	Refrigerator sills	4 to 5 years
Stock car roofing	4 to 6 years	Refrigerator sub-flooring	3 to 4 years
Stock car side posts	4 to 6 years		
Stock car end posts	6 to 8 years		

Using 4 years as the average life of untreated stock car decking and 16 years as the average life of treated stock car decking, we find that the cost per year of untreated decking is $8.36 per car and of treated decking is $2.71, a saving of $5.65.

The yearly cost is as follows:

Maintenance of untreated decking is	$8.36
Maintenance of Bethel Process treated decking is	2.71
Maintenance of Empty Cell treated decking is	2.41
Maintenance of Card treated decking is	2.33
Maintenance of Burnettizing treated decking is	2.19

In these figures there has been no consideration of the loss of service of the car while it is in the repair yards having decayed parts changed out, neither has there been any consideration of the destruction of other material that is in good condition necessitated by the changing out of bad order parts.

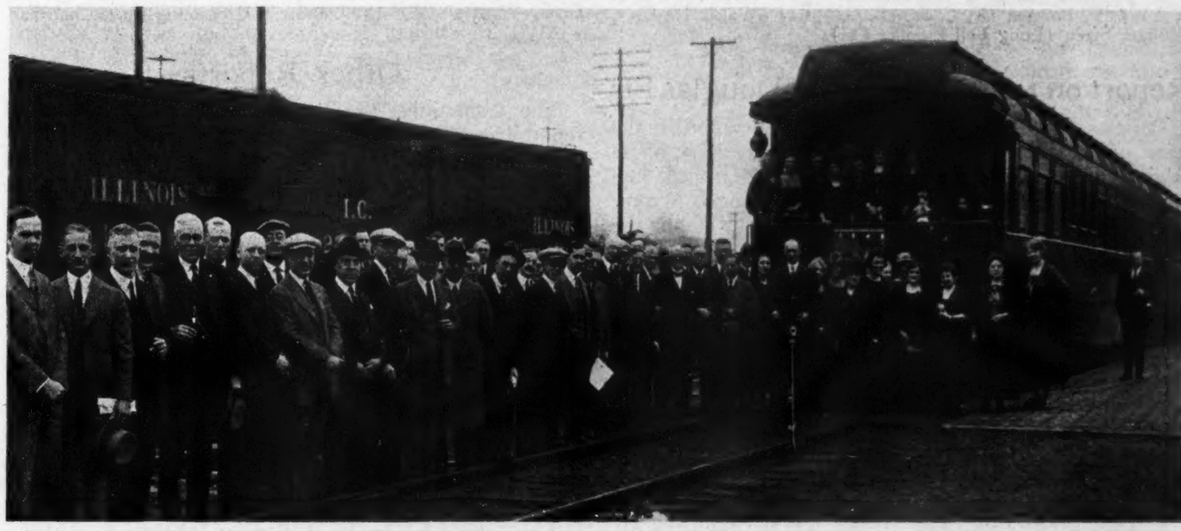
F. S. Shinn (C. B. & Q.), Chairman; K. C. Barth (Wood Preservers Service Bureau), H. C. Bell (N. & W.), S. M. Elder Elder (B. & O.), F. McCrory (C. R. I. & P.).

Report on Pressure Treated Posts

The average life that may be obtained from the woods commonly used for posts is as follows:

Bois D'Arc	20 years	Chestnut	10 years
Catalpa	18 years	Pine	8 years
Locust	18 years	Oak	8 years
Cedar	15 years		

Many of the larger railroads have been using creosoted or zinc treated fence posts in more or less varying quantities for the past eight or ten years. One eastern line used creosoted beech, birch and maple posts as far back as 1911 but most of the pressure treated posts in service today are creosoted yellow pine, several million of which are on roads in the southwest. These are for the most part round pine saplings cut into seven foot lengths with a four inch minimum top diameter. They are thoroughly peeled and air seasoned before treatment and, in most cases, given a six or eight pound treatment with creosote.



The Wood Preservers En Route

That creosoted yellow pine posts can be used advantageously in territories where the fire hazard is great is proven by records which have been kept on the M. K. & T. of the number of treated and untreated posts destroyed by fire during the burning of the right of way in 1920 and 1921. The following data were furnished by the engineering department of that road.

	Posts in service	Posts destroyed by fire
Untreated	1,651,333	5,795
Creosoted	378,578	76
Total	2,030,911	5,871

A direct comparison of the relative fire resisting qualities of treated and untreated posts cannot be made from the above data as many of the untreated posts were partially decayed, making the wood readily susceptible to the flames. But the fact that less than 100 treated posts burned out of a total of more than 378,000 in service is evidence that they are not easily ignited and therefore are desirable in territories where there is danger of fire.

Creosoted pine posts are generally uniform in size and present a noticeable contrast to the cedar and Bois' D Arc commonly seen in right of way fences. There was some objection at first to the use of pine for fence posts on account of the softness of the wood, the thought being

that the staple would not be firmly imbedded in the wood. This was overcome, however, by increasing the length of the staple.

It is recommended that as many railroads as possible be induced to conduct experiments to determine by actual practice the most suitable post for adoption. The M. K. & T. has used treated posts exclusively for the past six years and in order to secure comparative data between them and steel posts, 10,000 of the latter were purchased recently and test sections established similar to those for cross ties and an accurate service record will be maintained of the posts in these sections. Concrete posts are in use on a number of roads and if each road would establish sections where the concrete posts could be compared with creosoted or zinc treated pine the data would be of great value in future years.

W. J. Smith (M. K. & T.), chairman; J. E. Bernhardt (C. & E. I.), I. V. Bowden (K. C. S.), F. G. Moore (Walsh Tie Co.), William Steen (Long Bell Lumber Co.).

Report on the Treatment of Douglas Fir

Douglas Fir is a somewhat "refractory" wood in the sense of absorbing preservatives. In the territory of its origin, Douglas Fir is generally artifically seasoned during treatment. In the main artifical seasoning is accomplished by steaming followed by vacuum, or by boiling the timber in creosote under a vacuum. In the earlier history of these processes, the temperatures used appeared to reduce the strength of the timber. In the recent past, marked progress has been made with improvements of process and reducing of treating temperatures.

It is the concensus of opinion of those experienced that still further improvements can be made available from observations and experiments now under way at the various plants in the Douglas Fir country.

These results of certain tests which have been made, while not conclusive, indicate:

1. That perforating may reduce the strength slightly over 6 per cent.

2. That the strength is further reduced by treatment so that when tested immediately after treatment the treated sticks may show 17½ per cent less strength than the natural unperforated pieces.

3. That when material is allowed to stand for 30 days after treatment the strength recovers somewhat and shows a decrease of about 5 per cent.

4. That at the end of six months the decrease is sightly less than 5 per cent.

5. That, with careful treatment, perforated Douglas Fir ties will not show any loss in strength based on compression perpendicular to grain, other than the initial loss due to perforating, when allowed to condition 30 days or more after the treatment.

Report on Adzing and Boring

The committee made inquiry of those roads which have adzed and bored ties before treatment. Based on the replies received the committee made the following recommendations:

1. That after 14 years of co-operative effort on the part of engineers, manufacturers and timber preservers, there have been developed methods whereby the preparation of ties to get the fullest service possible out of their treatment has been reached.

2. That the machinery for accomplishing this work has advanced to a point where there is no possible reason why one should hesitate to install it. There is no more experiment about it than there would be about the installation of a modern planer in a car shop, or a modern lathe in a machine shop.

3. That to get the fullest possible service out of our tie supply we recommend that every tie that can be put through a modern boring and adzing machine before treatment, should be so machined for the following reasons: A—A perfect rail bearing will be secured without the necessity of adzing after treatment. B—To enable one to adze the tie on an inclined plane with any desirable pitch for the purpose of canting the rail and securing a greater distribution of wear on head of rail. C—That perforations under the rail base, "the vulnerable point of a tie," shall be made so that the spike can be driven into treated wood, which in a great many cases is not possible without this perforation previous to treatment. D—That all ties should be stamped on end in a manner that will give a permanent record as long as the tie lasts.

George E. Rex (National Lumber & Creosoting Co.), Chairman.

Other Reports

The Committee on Preservatives presented a brief report from which the following is abstracted:

"Owing to the complexity of the chemical composition and physical properties of coal-tar creosote oil, and to the fact that some of the same compounds and properties which characterize coal tar creosote are found in certain petroleum derivatives, the determination of the purity of creosote oil is difficult. When there is not certain assurance that the oil is a pure product, the committee presented three tests designed to aid in arriving at an opinion as to its coal tar origin which were adopted by the association."

The committee also presented specifications for a light creosote oil for brush or spray treatment which was adopted by the association. The committee was instructed to prepare a similar specification for a heavy oil for presentation next year.

The Committee on Track Service Records presented a tabulation of cross tie renewals per mile of all tracks for eight roads as follows:

Year	P.R.R.	M.C.	C.C.C. & St. L.	U.P.	I.C.	K.C.S.	C.B.&Q.	A.T.& S.F.
1900	...	269	...	261	...	...	...	...
1901	289	241	...	242	...	...	...	...
1902	257	282	...	229	...	...	...	...
1903	237	237	...	186	...	...	...	...
1904	215	141	...	303	...	...	...	...
1905	262	148	369	266	...	...	...	...
1906	228	173	392	374	...	...	...	...
1907	247	110	301	317	...	...	...	...
1908	194	110	275	258	...	...	...	...
1909	245	272	198	253	...	...	...	...
1910	236	176	384	267	...	462	...	...
1911	218	285	388	246	290	432	...	...
1912	275	208	318	171	267	294	...	...
1913	260	305	282	231	286	350	...	...
1914	284	284	269	248	266	354	231	...
1915	289	335	277	238	253	354	227	...
1916	241	357	212	253	228	338	203	...
1917	197	227	202	196	179	240	192	...
1918	162	197	205	191	161	237	194	...
1919	192	144	201	185	198	273	162	...
1920	200	126	156	206	250	290	178	...
1921	228	154	194	184	...	311	177	149

The figures for the Union Pacific include cross, bridge and switch ties, 1900 to 1912 inclusive. Records are based on fiscal years 1900 to 1916, ending June 30, and on calendar years 1917 to 1921.

The Committee on Electrical Conductivity of Wood presented a report reviewing the investigations which have been made to determine the effect of the treatment of crossties on the signal circuit. The report concluded with the presentation of the conclusions of the Railway Signal Association on this subject in 1919.

The San Francisco Bay Marine Piling Committee presented a progress report describing the developments of the past year in the extensive investigation now under way to determine means of arresting the inroads of teredo and other marine borers on the Pacific Coast. This was

followed by the presentation of a paper prepared by William G. Atwood, director of the Marine Piling committee of the National Research Council, describing the investigations undertaken recently along the Atlantic Coast (described in *Railway Engineering and Maintenance* for January, page 21).

Following the presentation of a paper by Earl Stimson, chief engineer maintenance of way, Baltimore & Ohio, at the last convention concerning the practice of the Interstate Commerce Commission in charging the cost of treating ties to operation rather than to capital account, a committee was appointed to make a recommendation to the Interstate Commerce Commission on this subject. The committee reported that the question is one of accounting and in the last analysis has little or no effect on the amount of treated timber used. The committee concluded that the initiative in bringing this question before the Interstate Commerce Commission rests with the individual carrier and recommended that the Wood Preservers' Association take no further action in the matter.

The Committee on Steam Treatment reported that the steaming of timber during the treating process to improve the absorption and penetration of preservatives has been practiced extensively for many years. Experience has shown that steaming has considerable value for this purpose and under some circumstances is practically a necessity, while under other circumstances the effect of the steaming upon the strength of the wood may be such that its use is inadvisable. It seems to be universally recognized that seasoning of some kind is necessary before treatment. Whether it is best to depend entirely upon air seasoning or steam seasoning, to use a combination of the two, or to adopt some other method, is debatable. The committee revived the literature on the subject preliminary to undertaking extensive investigations to determine the effect of steaming and vacuum on the absorption and penetration of preservatives.

Another interesting feature of the program was a paper by W. T. Kelleher on the Lake Pontchartrain trestle. This is presented as a separate article on page 55.

Other Features

Late Wednesday afternoon an inspection of the docks and other structures along the New Orleans water front was made by steamer. On Friday a special train conveyed the members of the association to Lumberton, La., to visit the mills of the Edward Hines Lumber Company, stopping en route to visit the treating plant of the Southern Creosoting Company at Slidell, La.

At the closing session on Thursday morning the following officers were selected for the ensuing year: President, H. S. Sackett, assistant purchasing agent, Chicago, Milwaukee & St. Paul, Chicago; first vice-president, E. J. Stocking, vice-president, Central Creosoting Company, Chicago; second vice-president, S. D. Cooper, assistant manager of treating plants, Atchison, Topeka & Santa Fe, Topeka, Kan. Members executive committee: W. P. Wiltsee, principal assistant engineer, Norfolk & Western, Roanoke, Va., and E. E. Pershall, vice-president, T. J. Moss Tie Company, St. Louis, Mo. Kansas City, Mo., was selected as the place for the next convention.

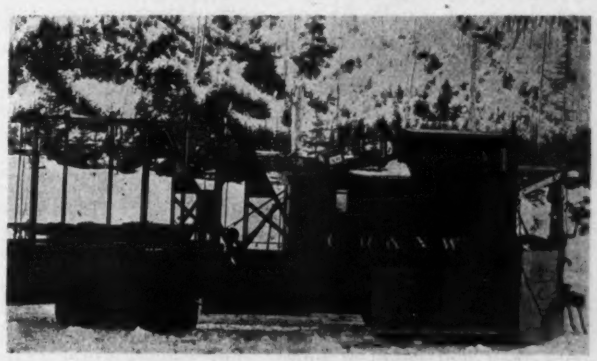
LOCOMOTIVE DELIVERIES—The shipments of locomotives in December, as compiled by the Department of Commerce from reports to the Bureau of the Census from the principal manufacturers, were the largest since January, 1921, and amounted to 210 locomotives. Unfilled orders on December 31 amounted to 1,592 locomotives, a slight decline from the previous month's record.

A Novel Snow Plow

By E. P. Harwood
Copper River & Northwestern, Cordova, Alaska

A NEW TYPE of snow plow, designed upon an entirely new principle in snow fighting equipment, has been operated successfully during the past winter by the Copper River & Northwestern Railway in Alaska. The wing snow plow, as it is called, serves to cut the snow from the deep banks at the sides of the road bed and draw it into the middle of the track behind the machine. This snow can then be thrown out easily by the regular rotary snow plows which follow.

The feature of the new plow is its arm or "wing." This is a reinforced steel arm 18 ft. long, curved throughout its width, and tapering from approximately 4 ft. wide at the car end, to about 2½ ft. wide at the outer end. This arm can be set at any angle from the car, but in general use it is extended out into the



The Plow Ready for Service

snow bank at the side of the tracks so that the outer end is about 12 ft. from the nearest rail. With the arm in this position and the car in motion, the wing cuts the snow from the bank and the snow slides inward toward the tracks. The rear end of the wing lies in such a position that the snow that curls along it is deposited immediately between the tracks behind the car.

The machine has only one wing, and a return trip is required to cut down both banks. When the return trip has been completed and the snow thrown out by the rotaries, a passageway 30 ft. wide has been opened, as compared to a cut of 12 ft. made by the rotaries alone without the wing plow.

The wing can be raised or lowered quickly through a distance of eight feet. This permits the operator to easily follow the banks and regulate the depth of the cut taken. The operator also can swing the arm back against the car readily when an obstruction is approached.

Power is derived from two compound steam engines with air cylinders as counterbalances. The engines are supplied with steam from the locomotive drawing the machine.

At the front of the plow on the wing side is another arm or wing of the ordinary pusher type. This is used where it is possible to push the snow away from the sides of the tracks, as in a canyon or at places where the road bed is higher than the ground immediately adjacent to it.

The machine is the invention of Charles Dustin, master mechanic of the Copper River & Northwestern railway, and was built completely at the Cordova shops.

The Secret of Handling Men*

A GOOD track laborer must know how to handle his pick, his shovel, his spike maul and all the other tools that are used in track work, in order to produce the best work with them. In somewhat the same way, the foreman must know how to handle his men in order to produce the best work with them. What he must do to get the best results under any condition with certain men may differ somewhat from what must be done under other conditions and with other men, but under any condition there are several things that a foreman desiring to handle his men well should keep in mind.

Be a Foreman, Not a Boss

The old idea of the foreman was a labor driver, conspicuous for his loud talk, swearing and "treat them rough" tactics. He was a boss and not a foreman. Nowadays, men will not stay with that kind of a foreman very long and usually do poor work while they stay. It costs a lot of money to break in new men and the foreman who is always changing men is wasting the company's money. Experts on "labor turnover" say it costs a company from $20 to $30 to break in one new laborer. The Ford Motor Company found a few years ago that its "turnover" was costing it an average of about $80 per man hired.

A good foreman is a leader, not a driver. He is one who uses his head more than his mouth, one for whom the men like to work because he knows his business. It is a mistake for a foreman to think that his men will like him because he is easy on them. They may tell the easy foreman he is a good fellow, but behind his back they will laugh at him. They usually know that a man who is dishonest with the company in letting them take it easy will be dishonest with them when he gets a chance. Of course, a foreman cannot let his men run over him, but he should never try to show his authority by giving orders which are not necessary just to show that he is boss.

Men Are Not All Alike

Men are as different as tools. A man does not handle a track level like a lining bar for if this was done the level would not do its work right. So it is that men need to be understood as well as tools to get the best work out of them. One man may need a little urging while another will do better when left alone. It is important in handling men, therefore, to study each man as a new and expensive tool, fitting the job to the man as much as possible. It is a fact that most men will do best the jobs they like. The big slow fellow and the small active one can each do some thing better than the other.

Building Up a Good Spirit

Cheerfulness is one of the best things in the world to help do a good day's work. If the foreman is happy on the job the gang soon gets into the same spirit. The result is always beneficial. It is also true that a workman likes to have a good word from the foreman when he has done well and the foreman ought not to forget to say it. To do so will help materially to keep up a good spirit in the gang. The men will also show a better spirit toward their track work, as they know more about what is going on in other departments of the road and the foreman is the logical man to talk to the men about these things; new cars ordered, a growing freight business, the service rendered to the public, etc., a knowledge of these facts by putting men in the frame of mind to feel that they are part of a live railroad, and that they are an important part of it, will go a long way in building up the spirit that often distinguishes a good worker from a poor one.

Practicing the Golden Rule

"Do unto others as you would have others do unto you" is a rule of conduct about 2,000 years old, but it is one of the most important rules in industry today. The foreman who does not practice it is simply not up to date and can't keep the good will of his men very long or keep a good spirit in his gang. Let him put himself in the other man's place, look at the job from that side, look back to the time when he first started and recall how he would like to have been treated. Remembering that it was not favors that were wanted then, that it was rather a square deal, the foreman should take special pains to give it to the new men, sending them home at night with the feeling that he is the squarest boss they have ever worked for.

In addition to this, it should be remembered that every man has ambition, has some place he wants to reach in life. Maybe he wants to buy a little home or get his family here from the old country or work up to a better job. Here is an opportunity for the foreman again to practice the golden rule by helping him along. The foreman who is not interested in helping his men is usually the one who has a gang of men who are not interested in helping him.

Getting the Work Done

The foreman is put in charge of the gang to get the work done, and to get it done on time, and to get it done right. One day at the Bethlehem Steel Works some laborers were each unloading 12½ tons of pig iron. While they were so working, they were closely observed with the result that after much study and testing, the men were trained to unload 47 tons a day. If this could be done on a job like unloading pig iron, it would seem that there is a chance for a good track foreman to improve the work of the average section gang. Certainly the amount of a fair day's track work has not reached a point where a good foreman with a good gang of the right spirit can not make a new record without overworking anybody.

Men really like to work and are much happier out on the job than they are sitting around the section house in rainy weather. They always complain about hard work, but they really like it, especially if they become interested in it. Every foreman should carefully plan his work, pick the men best suited for each part of the job and see if they cannot do a better day's work and be less tired than before. Some foremen have found that their men got a lot of fun out of beating their own record or the record of some other gang. This does not require overworking the men. It is simply the means of putting a little of the spirit of competition or play into the work that drives away the monotony.

The biggest job in the world is the job of handling men. The better a man gets at it the bigger a job he can get and the more companies there will be that will want him on their payroll.

British Roads Consolidate—In a little more than a year's time the railroads of England have been combined into four systems through an exchange of securities under the Railways Act which was passed in 1921.

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*A lesson taught in the Track Foreman's School of the Chicago, North Shore & Milwaukee.

Salaries of Railway Engineer Officers

Report Prepared by Senate Committee Contains Interesting Data on Compensation Supplied by the Carriers

An opportunity for a comparison of the salaries paid to officers on the various roads has been made possible through the publication in book form by the Senate Committee on Interstate Commerce of data which the railroads were required to furnish to the committee in the form of sworn statements covering the salaries of all officers receiving compensation amounting to $5,000 or more. The list as published by the commission covers 225 pages of closely printed tables and from these, as being of special interest to the readers of *Railway Engineering and Maintenance,* we have abstracted the names of all engineering officers given in the table, together with their compensation.

The order requesting this information is rather ambiguous, the specific instructions to the railroads being as follows:

"1. A list of all officers, attorneys, publicity agents and other employees of each railroad receiving compensation amounting to $5,000 or more during the calendar years 1914 to 1917, and appropriate compensation for the 10 months, March 1 to December 31, 1920, and for the first six months of 1921.

"2. Any increase or decrease in the salary or compensation of any officer, attorney or employee receiving $5,000 or more per annum since March 1, 1920, and the date and amount of such increase or decrease."

An examination of the table makes it clear that it is not entirely complete; some roads are omitted and on other roads, as in the case of the Pennsylvania, the list as presented does not correspond to the present form of organization. Some of the roads also have misinterpreted the instructions, as for instance in the case of the Chicago & Northwestern, where the salaries given for the first six months of 1921 are very obviously the salaries for the entire year. In examining these tables the reader should bear in mind that the latest information given is for the first half of 1921 and that therefore there has been opportunity for considerable changes in compensation since that date.

Name and Titles of Employees	Amount of Compensation: Year Ended Dec. 31, 1914	Year Ended Dec. 31, 1917	10 Months March 1 to Dec. 31, 1920	6 Months Jan. 1 to June 30, 1921
Atchison, Topeka & Santa Fe—				
M. C. Blanchard, district engineer	$ 2,100	$ 2,970		
C. F. W. Felt, chief engineer system.	8,000	9,000	$10,000	$ 6,000
G. W. Harris:				
Assistant chief engineer system			7,500	4,500
Chief engineer, Coast Lines	4,800	5,700		
J. Weidel:				
Valuation engineer system		4,200	5,400	3,300
Assistant engineer	2,400			
H. W. Wagner, chief engineer	3,000	3,720	6,000	3,600
F. M. Bisbee, chief engineer	4,533	5,700	6,000	3,600
A. F. Robinson, bridge engineer	4,800	5,000	5,400	3,300
E. G. Allen, assistant engineer	1,870	3,000	5,200	2,700
W. Howe, locating engineer	3,300	3,960	4,400	2,580
R. B. Ball:				
Chief engineer, Coast Lines			5,500	3,300
Engineer grand division	2,400	3,080		
F. Merritt, chief engineer, Gulf Lines	4,800	5,100	3.500	3,300
Atlanta, Birmingham & Atlantic—				
L. L. Beall, chief engineer			4,533	
Atlantic Coast Line—				
E. B. Pleasants, chief engineer	7,140			
J. E. Willoughby, chief engineer		8,400	8,916	6,000
D. W. Gross, engineer, construction	3,000			
C. M. James, engineer, construction		3,888	4,400	
D. M. Lamdin, engineer, construction				2,700
E. P. Laird, engineer roadway, first division	2,700			
J. B. Trenholm:				
Engineer roadway, first division		2,916		
Engineer maintenance of way, first division			3,958	2,500
J. C. Chenworth, engineer roadway, second division	3,000			
E. B. Hillegass:				
Engineer roadway, second division		2,916		
Engineer maintenance of way, second division			3,958	2,500
L. L. Sparrow, engineer roadway, third division	2,700			
H. G. Laird:				
Engineer roadway, third division		2,916		
Engineer maintenance of way, third division			3,958	2,500
Baltimore & Ohio—				
L. G. Curtis, chief engineer, adjustment division				5,000
C. C. Cook, maintenance engineer, adjustment division				2,550
J. B. Jenkins, valuation engineer	4,200	4,200		3,450
H. B. Dick, assistant engineer		2,400		2,550
C. P. Van Gundy, water engineer	2,700	2,700		2,550
F. L. Stuart, chief engineer	14,000			
H. A. Lane, chief engineer		8,500		6,700
H. R. Talcott, assistant chief engineer.	4,800	6,000		4,050
M. A. Long, assistant to chief engineer	4,800	4,800		
E. L. Gosnell, assistant to chief engineer				2,550
P. Didier, principal assistant engineer	4,800	5,400		2,850
A. M. Kinsman, engineer construction.	4,800	4,800		2,500
J. T. Wilson, district engineer	3,600	3,900		
R. Mather, district engineer				3,090
C. Brown, district engineer	2,100			
A. C. Clark, district engineer				3,090
A. H. Griffith, district engineer		3,300		3,090
W. S. Bouton, engineer of bridges	4,000	4,800		
P. G. Lang, engineer of bridges				3,990
A. B. Scowden, assistant engineer of bridges	2,226	2,700		2,400
L. P. Kimball, engineer of buildings				3,450
F. L. Riley, assistant engineer of buildings	1,800	2,100		2,370
J. H. Milburn, office engineer	2,400	2,700		2,730
E. Stimson:				
Engineer maintenance of way, Eastern lines	4,800	5,400		
Chief engineer maintenance				5,000
S. A. Jordon:				
Engineer maintenance of way, Western lines				3,990
E. G. Lane:				
Engineer maintenance of way, Western lines	3,000	3,000		
Engineer maintenance of way, Eastern lines				3,990
W. McBonn, assistant to chief engineer, maintenance	2,280			
G. M. Andrews, assistant to chief engineer, maintenance		3,000		2,400
J. B. Myers, engineer, roadway and track	3,000	3,300		2,550
W. I. French, division engineer	2,416			
H. M. Church, division engineer		2,700		
G. S. Crites, division engineer				2,400
P. Petri, division engineer	2,500			2,400
F. F. Hauley, division engineer		2,400		
E. T. Brown, division engineer	2,400			
G. F. Eberly, division engineer		2,580		
A. H. Freygang, division engineer				2,400
F. G. Hoskins, division engineer	2,226			
A. P. Williams, division engineer		2,580		
H. R. Gibson, division engineer				2,400
C. C. Cook, division engineer	2,544			
H. H. Harsh, division engineer	2,226	2,700		2,400
J. B. Cameron, division engineer	2,220			
D. W. Cronin, division engineer		2,400		
E. J. Correll, division engineer				2,400
A. R. Carver, division engineer		2,220		2,400
T. J. Parrish, division engineer		2,400		
H. R. Gibson, division engineer				
R. E. Chamberlain, division engineer				2,400
G. P. Grimsley, geological engineer		3,000		3,090
Bangor & Aroostook—				
Moses Burpee, chief engineer	5,000	5,000	4,166	2,500
Belt Railway of Chicago:				
E. H. Lee, vice-president and chief engineer	3,000	3,437	5,000	3,000
Bessemer & Lake Erie—				
H. T. Porter, chief engineer	4,800	11,012	15,331	3,500
F. R. Layng, engineer of track	2,640	4,018	4,952	2,500
Boston & Albany—				
F. B. Freeman, chief engineer	7,000	7,000	7,333	4,500
Boston & Maine—				
A. B. Corthell, chief engineer	10,000	10,000	8,333	5,000
F. C. Shepherd, principal assistant engineer		5,000	5,316	3,300
F. A. Merrill:				
Division engineer	2,700			
Engineer maintenance of way		5,000	5,400	3,300
H. J. Sargent, assistant chief engineer			4,750	
B. W. Guppy, bridge engineer		1,666	4,360	2,700
Buffalo, Rochester & Pittsburgh—				
E. F. Robinson, chief engineer	8,500	10,333	10,500	7,500

Name and Titles of Employees	Amount of Compensation: Year Ended Dec. 31, 1914	Year Ended Dec. 31, 1917	10 Months March 1 to Dec. 31, 1920	6 Months Jan. 1 to June 30, 1921
E. W. Hammond, engineer maintenance of way			4,791	3,500
W. F. Pond, office engineer			3,875	2,850
E. G. Foster, valuation engineer			3,625	2,700
D. S. Watkins, engineer of construction			4,375	3,000
F. A. Benz, division engineer			3,625	2,550
J. B. Oatman, division engineer			3,625	2,550
Carolina, Clinchfield & Ohio R. R. Co. and Carolina, Clinchfield & Ohio R. R. of South Carolina—				
Ward Crosby, chief engineer	5,000			
O. K. Morgan, chief engineer		3,600	4,558	3,000
W. C. Hattan, engineer in charge				2,499
Central of Georgia—				
C. K. Lawrence, chief engineer	5,400	5,400	6,475	4,200
C. P. Hammond, engineer maintenance of way	3,600			
C. E. Weaver, engineer maintenance of way		4,200	5,152	3,300
Central Vermont—				
F. D. Fitzpatrick, chief engineer	2,400	2,541	5,075	3,210
Chesapeake & Ohio—				
H. Frazier, consulting engineer	Less	Less	4,500	1,875
F. I. Cabell, chief engineer	6,000	6,900	7,250	2,250
C. W. Johns, engineer of construction			4,875	3,600
Chicago & Alton—				
H. T. Douglas, Jr., chief engineer	6,000	5,700	5,780	3,630
Chicago & Eastern Illinois—				
L. C. Hartly, chief engineer			5,375	3,450
Chicago & North Western*—				
W. J. Towne, chief engineer	15,000	15,000	15,000	15,000
D. Rounseville, assistant chief engineer	3,600	3,900	7,200	7,200
J. S. Pole, assistant engineer, track elevation			5,100	5,100
J. A. Lorch, assistant engineer, valuation	4,200	5,000	4,800	4,800
C. T. Dike, engineer of maintenance.	4,500	4,500	10,000	10,000
F. C. Huffman, assistant engineer of maintenance			6,600	6,600
J. A. S. Redfield, assistant engineer of maintenance			5,700	5,700
O. F. Dalstrom, engineer of bridges	4,500	3,000	5,700	5,700
Chicago, St. Paul, Minneapolis & Omaha—				
H. Rettinghouse, chief engineer	6,000	6,000		
H. E. Barlow, chief engineer			5,000	3,000
Chicago Great Western—				
L. C. Fritch, chief engineer	896			
C. G. Delo, chief engineer	2,855	3,725	4,400	3,000
Chicago, Burlington & Quincy—				
T. E. Calvert, chief engineer	10,000			
A. W. Newton, chief engineer	6,000	12,000	10,000	6,000
W. L. Breckinridge, assistant chief engineer	7,000	7,000	6,500	3,750
F. T. Darrow, assistant chief engineer	3,600	4,200	5,900	3,600
C. L. Persons, assistant chief engineer	1,980	3,000	4,900	3,000
C. H. Cartlidge, engineer of bridges	6,000			
G. A. Haggander, engineer of bridges	2,400	3,900	5,400	3,300
W. T. Krausch, engineer of buildings.	5,000	5,541	6,400	3,900
H. S. Marshall, engineer of valuation			5,700	3,600
B. M. Cheney, general inspector permanent way and structure	1,775	2,857	4,150	2,550
Cleveland, Cincinnati, Chicago & St. Louis—				
L. S. Rose, valuation engineer	3,852	4,344		
G. P. Smith:				
Chief engineer	6,935			
Consulting engineer		2,600	3,054	2,130
C. A. Paquette:				
Chief engineer, maintenance of way	4,334			
Chief engineer		6,935	7,102	4,735
H. Baldwin, assistant chief engineer			5,824	3,267
O. E. Selby:				
Engineer bridge and building	2,889			
Principal assistant engineer		3,852	4,829	2,983
P. Hamilton, engineer roadway and track	2,889	3,082	4,119	2,556
J. B. Hunley:				
Assistant engineer	2,196			
Engineer bridge and building		3,082	4,119	2,556
Chicago, Milwaukee & St. Paul—				
C. F. Loweth, chief engineer	15,000	15,000	12,500	7,500
W. H. Penfield, engineer maintenance of way			6,300	4,500
A. G. Holt, assistant chief engineer	5,000	5,000	4,366	2,800
W. W. K. Sparrow, assistant chief engineer			2,500	
E. O. Reeder, assistant chief engineer	6,000	6,000		
R. J. Middleton, assistant chief engineer			5,200	3,300
A. E. Lodge, valuation engineer			4,000	2,500
C. H. Koyl, engineer water supply			5,000	3,000
Chicago, Rock Island & Pacific and Chicago, Rock Island & Gulf—				
C. A. Morse, chief engineer	15,000	15,000	12,500	7,500
R. H. Ford:				
Assistant chief engineer			2,800	3,450
Principal assistant engineer			2,500	
J. M. Brown, engineer of maintenance			5,200	3,300
I. L. Simmons, bridge engineer	3,000	3,600	4,500	3,000
A. T. Hawk:				
Engineer of buildings			4,500	3,000
Architect		450		
R. C. Sattley, valuation engineer	3,600	3,600	4,300	475
E. P. Skene, special assistant valuation engineer				2,432
W. H. Peterson, engineer maintenance of way	4,000	4,000	4,800	3,150
J. M. Brown, engineer maintenance of way	3,300			

*Returns for all C. & N. W. items for 1922 are clearly for the entire year instead of the first six months.

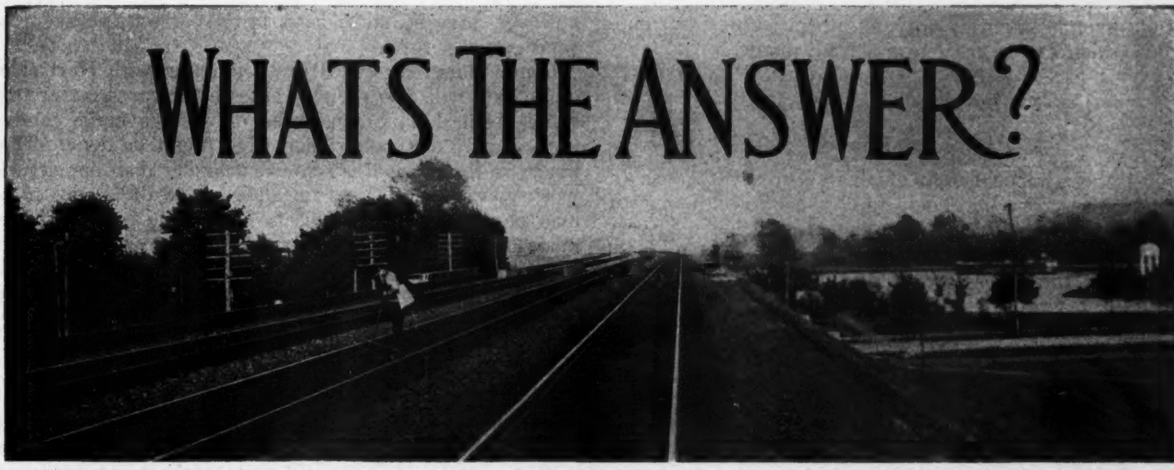
Name and Titles of Employees	Amount of Compensation: Year Ended Dec. 31, 1914	Year Ended Dec. 31, 1917	10 Months March 1 to Dec. 31, 1920	6 Months Jan. 1 to June 30, 1921
F. L. Beckett, engineer maintenance of way	3,000	3,050	4,800	3,150
Delaware & Hudson—				
James MacMartin, chief engineer	3,600	6,000	6,600	4,000
R. R. Rumery, consulting tax engineer			4,166	2,500
W. H. Mansfield, engineer			430	2,580
W. B. Leonard, engineer maintenance of way	2,160	3,140	4,133	2,500
Denver & Rio Grande Western—				
J. G. Gwyn, chief engineer	6,000	6,000	5,500	3,300
A. Ridgway, assistant chief engineer.	3,600	4,100	4,166	2,499
El Paso & Southwestern—				
J. L. Campbell, chief engineer	6,000	6,140	7,066	4,600
Florida East Coast—				
E. Ben Carter, chief engineer	4,500	5,000	2,000	
H. N. Rodenbaugh, chief engineer			5,000	5,000
Grand Trunk—				
T. T. Irving, chief engineer			5,666	4,000
Great Northern—				
A. G. Hogeland:				
Consulting Engineer	1,875			
Chief engineer	10,000	15,000	12,500	7,500
R. Budd, chief engineer	3,333			
C. M. Nye:				
Principal assistant engineer	4,200	5,000		
Assistant chief engineer			5,458	3,750
O. S. Bowen:				
Principal assistant engineer	3,145	5,000		
Assistant chief engineer			5,458	3,750
A. Stewart, assistant chief engineer	2,600			
H. S. Woolan, district engineer	2,400	3,400		
H. J. Seyton, district engineer			4,125	2,700
H. F. Hamilton, district engineer	3,000	3,350	4,375	3,000
P. S. Hervin, district engineer	3,000	3,500	4,125	675
T. G. Hastie, district engineer			4,125	675
E. E. Adams, district engineer				2,025
O. S. Bowen, district engineer	1,669			
T. G. Hastie, district engineer				2,025
J. A. Bohland, bridge engineer	3,600	3,600	4,375	3,000
A. A. Leach:				
Assistant valuation engineer	3,150			
Valuation engineer		1,850		
G. D. Eddy:				
Assistant valuation engineer		1,500		
Valuation engineer			4,450	3,000
H. K. Dugan, assistant valuation engineer			3,900	2,550
J. R. W. Davis, engineer maintenance of way	6,000	6,000	6,500	4,500
Gulf Coast Lines—				
C. S. Kirkpatrick, chief engineer				2,500
Hocking Valley—				
W. Michel, chief engineer	2,926	2,700	4,875	3,150
Illinois Central and Yazoo & Mississippi Valley—				
F. L. Thompson, chief engineer	9,000	12,000	10,500	6,600
A. F. Blaess, engineer maintenance of way	2,800	6,000	7,583	4,850
W. G. Arn, assistant engineer maintenance of way	None	2,700	4,369	2,850
D. W. Thrower, valuation engineer	4,500	6,000	4,500	3,000
A. L. Davis, principal assistant engineer	4,725	6,000	6,088	3,800
F. R. Judd, engineer of buildings	3,300	2,900	4,375	3,000
C. C. Westfall, engineer of bridges	None	3,200	4,375	3,000
A. B. B. Harris, locating engineer	3,300	3,500	4,000	2,550
E. L. Crugar, district engineer	3,000	3,000	4,350	2,850
W. M. Vandersluis, engineer secretary.	None	None	4,450	3,330
D. J. Brumley, chief engineer Chicago Terminal improvement	None	None	7,250	5,100
L. H. Bond, district engineer	3,000	3,000	3,650	2,850
M. M. Backus, district engineer	None	None	3,650	2,850
International & Great Northern—				
O. H. Crittenden, chief engineer	4.000	333		
J. C. Resch, chief engineer		3,667		
F. S. Schwinn, chief engineer			4,300	2,975
Kansas City Southern, including Texarkana & Fort Smith—				
C. E. Johnston, chief engineer	5,000			
J. M. Weir, chief engineer		5,000	5,950	3,600
Long Island—				
J. R. Savage, chief engineer	7,800			
L. V. Morris. chief engineer		8,400	7,500	4,500
Los Angeles & Salt Lake—				
E. C. Tilton, assistant chief engineer } A. M. Maguire, assistant chief engineer }	4,900	5,100	5,000	3,000
Louisville & Nashville—				
W. H. Courtenay, chief engineer	5,000	5,250	6,666	4,000
C. H. Blackman, principal assistant engineer	4,050	3,810	4,160	2,640
Maine Central—				
B. T. Wheeler, chief engineer	8,000	8,000	7,333	4,250
G. F. Black, engineer maintenance of way	3,300	4,200	4,516	2,600
A. H. Morrill, engineer construction	3,300	4,200	4,516	2,600
Michigan Central—				
J. F. Deimling:				
Assistant chief engineer	3,600	2,250		
Chief engineer		3,000		
Assistant chief engineer			5,600	3,600
George H. Harris:				
Engineer of tracks	3,000			
Engineer maintenance of way		1,800		
Assistant chief engineer		2,250		
Special engineer			1,600	
Engineer maintenance of way			2,760	2,880
B. H. Persons, office engineer	2,340	2,760	3,795	
E. R. Lewis, office engineer				1,958
A. L. Sarvey, valuation engineer	3,600	3,900	4,160	2,880
H. Ibsen, bridge engineer	3,000	4,200	4,360	2,880

Name and Titles of Employees	Amount of Compensation: Year Ended Dec. 31, 1914	Year Ended Dec. 31, 1917	10 Months March 1 to Dec. 31, 1920	6 Months Jan. 1 to June 30, 1921
J. C. Tuthill:				
Assistant bridge engineer	2,160	......	......	......
Acting bridge engineer	......	3,000	......	......
Bridge engineer	......	......	4,100	2,550
Minneapolis & St. Louis—				
R. G. Kenly, assistant to president and chief engineer	......	......	6,666	4,000
W. A. Christian, special engineer	......	......	4,596	1,500
Minneapolis, St. Paul & Sault Ste. Marie—				
C. N. Kalk, chief engineer	6,000	......	......	......
E. A. Whitman, chief engineer	......	6,000	6,900	4,200
Missouri, Kansas & Texas Lines—				
F. Ringer, chief engineer	......	......	7,000	4,200
E. L. Martin, assistant chief engineer	......	......	5,500	......
E. E. Mousand, engineer maintenance of way	......	......	4,500	......
E. L. Martin, engineer maintenance of way	......	......	......	3,300
B. J. Dalton, valuation engineer	6,000	6,000	......	......
S. F. Fisher, valuation engineer	......	......	2,500	......
A. W. Galbreath, valuation engineer	......	......	2,500	3,000
H. H. Johntz, engineer maintenance of way	......	......	4,750	2,850
J. M. Metcalf, principal assistant engineer	......	......	4,500	2,700
Missouri Pacific—				
J. R. Stephens, chief engineer	12,000	......	......	......
R. C. White:				
Engineer maintenance of way	2,025	......	......	......
Assistant chief engineer	......	......	1,000	......
A. A. Miller:				
Engineer maintenance of way	......	3,000	......	......
Engineer maintenance of way	......	......	800	......
E. A. Hadley:				
Assistant engineer	3,300	......	......	......
Chief engineer	......	8,000	10,000	6,000
H. R. Carpenter:				
Engineer maintenance of way	3,600	......	......	......
Assistant chief engineer	......	4,200	6,667	4,000
J. R. Leighty:				
Engineer maintenance of way	3,600	3,600	......	......
Assistant chief engineer	......	......	5,000	3,000
S. L. Wonson, bridge engineer	2,700	3,300	800	......
S. L. Wonson, bridge engineer	......	......	3,600	2,700
A. F. Dorley:				
Principal assistant engineer	675	......	......	......
Principal assistant engineer	2,250	......	......	......
Engineer maintenance of way	......	3,120	800	......
Engineer maintenance of way	......	......	3,600	2,700
C. O. Congdon:				
Engineer maintenance of way	......	......	......	1,350
H. E. Hale:				
Engineer maintenance of way	900	......	......	......
W. H. Vance:				
Engineer maintenance of way	......	......	800	......
Engineer maintenance of way	......	......	3,600	2,700
C. H. Smith, valuation engineer	6,000	......	......	......
H. C. Searls:				
Assistant engineer	2,100	......	......	......
Valuation engineer	......	1,125	800	......
Valuation engineer	......	1,750	3,600	2,700
Nashville, Chattanooga & St. Louis—				
Hunter McDonald, chief engineer	5,250	5,400	6,000	3,600
G. F. Blackie, assistant chief engineer	2,160	3,300	3,900	2,520
New York Central—				
G. W. Kittredge, chief engineer	17,078	16,662	15,000	9,000
P. H. Dudley, consulting engineer	4,871	5,050	3,427	2,249
C. J. Parker:				
Principal assistant engineer	6,600	7,200	......	......
Chief fire protection engineer	......	......	3,346	2,008
W. F. Jordan, principal assistant engineer	......	......	6,650	4,050
G. A. Harwood:				
Chief engineer, electric zone improvement	9,600	......	......	......
Engineer assistant to vice-president	......	12,000	......	......
R. D. Starbuck, special engineer to vice-president	3,579	......	......	......
G. C. Cleveland, chief engineer	9,000	9,000	8,500	5,500
R. O. Rote, assistant chief engineer	6,000	6,000	5,650	3,750
J. W. Pfau, engineer, construction	6,000	6,900	6,650	4,050
S. Rockwell, consulting engineer	10,000	10,000	......	......
G. W. Vaughan, engineer maintenance of way	7,200	7,500	2,479	......
J. V. Neuberg:				
Engineer of track	3,600	3,780	1,512	......
Engineer maintenance of way	......	......	4,604	4,250
C. B. Martin, transportation engineer	3,600	3,725	4,600	2,850
H. D. Jouett:				
Designing engineer	3,000	1,925	......	......
Terminal engineer	......	1,500	4,750	2,940
H. B. Reinsagen:				
Principal assistant engineer	3,600	650	......	......
Engineer, maintenance of way	......	3,750	4,400	2,912
R. E. Dougherty:				
District engineer	3,600	3,780	......	......
Designing engineer	......	......	4,750	2,940
B. C. Martin:				
Assistant district engineer	2,400	3,000	......	......
District engineer	......	......	4,350	2,350
J. L. Holst, engineer of structures	4,800	5,100	......	......
W. A. Murray:				
Division engineer	2,880	2,880	......	......
Engineer of track	......	......	4,506	2,850
F. S. Hunt, division engineer	3,600	3,780	4,350	2,700
W. L. Morse, special assistant engineer	......	4,800	5,480	3,360
C. E. Lindsay:				
Division engineer	3,600	......	......	......

Name and Titles of Employees	Amount of Compensation: Year Ended Dec. 31, 1914	Year Ended Dec. 31, 1917	10 Months March 1 to Dec. 31, 1920	6 Months Jan. 1 to June 30, 1921
Member Bi-Partisan Wage Board and Special engineer	......	3,780	6,966	3,360
H. W. Fenno:				
Resident engineer	2,100	......	......	......
Division engineer	......	3,300	4,350	2,700
C. Yoder:				
Assistant engineer	2,700	......	......	......
Engineer of track	......	3,300	4,600	2,850
B. R. Leffler, engineer of bridges	3,300	3,600	4,600	2,850
A. M. Currier:				
Assistant engineer	......	2,300	......	......
Principal assistant engineer	......	3,600	4,600	1,187
Engineer grade separation	......	......	......	1,277
G. N. Edmondson, division engineer	2,580	2,700	4,163	2,700
P. H. Winchester, division engineer	2,580	2,700	3,900	2,700
H. C. Thompson, division engineer	3,000	3,180	4,100	2,550
S. C. Upson:				
Assistant engineer	1,920	......	......	......
Division engineer	......	3,300	4,350	2,700
P. E. Manchester:				
Assistant engineer	2,700	......	......	......
Division engineer	......	3,300	4,350	2,700
J. M. Podmore, division engineer	2,580	3,200	4,350	2,700
F. Boardman, division engineer	4,165	4,153	4,231	2,671
B. M. McDonald, division engineer	3,600	3,780	4,350	2,700
C. P. Marsh:				
Bridge engineer	2,820	3,000	......	......
Acting engineer of structures	......	......	4,750	2,940
H. T. Welty:				
Bridge engineer	3,600	......	......	......
Engineer of structure	......	3,955	4,750	2,940
J. H. Roach, valuation engineer	3,500	4,800	7,200	4,320
A. W. Carpenter:				
Engineer of structures	4,800	......	......	......
Assistant valuation engineer	......	4,800	4,800	2,880
E. B. Menuez:				
District engineer	3,600	......	......	......
Assistant valuation engineer	......	4,630	4,800	2,880
A. M. Holcomb, office engineer	4,200	4,625	4,875	3,000
New York, Chicago & St. Louis—				
E. E. Hart chief engineer	4,200	5,000	6,400	4,200
W. J. Bergen, constructing and valuation engineer	......	......	5,200	3,300
A. J. Himes, valuation engineer	3,600	4,150	......	......
New York, New Haven & Hartford—				
H. L. Ripley:				
Corporate and valuation engineer	......	......	5,900	3,600
Valuation engineer	5,000	5,000	......	......
E. Gagel, chief engineer	10,000	10,000	8,933	5,400
I. D. Waterman, engineer of construction	......	......	5,250	3,300
W. H. Moore, engineer of structures	6,000	6,000	2,375	......
P. B. Spencer, engineer of structures	......	......	1,350	2,700
W. T. Dorrance, designing engineer	......	......	3,983	2,500
A. S. Tuttle, assistant engineer of construction	......	......	......	1,700
W. J. Backes, engineer maintenance of way	5,000	5,825	7,300	4,500
P. Sterling:				
Assistant to engineer maintenance of way	......	......	......	2,250
Maintenance engineer, lines west	......	......	4,380	450
R. L. Pearson, maintenance engineer lines west	......	......	......	1,875
W. D. Warren, maintenance engineer lines east	......	......	4,380	2,700
Norfolk & Western—				
Charles F. Losh, valuation engineer	3,000	3,630	5,000	3,000
J. E. Crawford, chief engineer	6,000	9,600	8,600	5,400
F. P. Turner, bridge engineer	3,600	4,500	4,480	2,760
J. R. Schick, engineer branch lines	4,200	4,500	4,230	2,610
Norfolk Southern—				
F. L. Nicholson, chief engineer	4,000	4,400	5,400	3,300
Northern Pacific—				
W. L. Darling, chief engineer	20,000	......	......	......
H. E. Stevens:				
Chief engineer	......	10,000	10,000	6,000
Bridge engineer	3,600	......	......	......
A. M. Burt, chief engineer maintenance of way	6,000	6,000	......	......
S. J. Bratager, principal assistant engineer	3,900	4,500	5,900	3,750
A. R. Cook, principal asssistant engineer	5,000	5,000	5,300	3,300
P. E. Thian, valuation engineer	4,000	4,000	4,975	3,300
L. M. Perkins, engineer maintenance of way	4,000	4,000	......	......
Lewis Yager:				
Engineer maintenance of way	......	3,812	4,900	3,300
District engineer	3,000	......	......	......
A. Gibson, engineer maintenance of way	3,600	......	......	......
Bernard Blum:				
Engineer maintenance of way	......	......	5,200	3,300
District engineer	......	3,087	......	......
M. F. Clements, bridge engineer	......	3,600	4,625	3,000
J. T. Derrig, district engineer	......	......	4,350	2,700
F. J. Taylor, district engineer	3,600	3,600	4,350	2,700
I. D. Koren, district engineer	3,000	3,000	4,350	2,700
B. L. Crosby, district engineer	3,300	2,200	......	......
A. F. Stotler, district engineer	......	900	4,350	2,700
Pittsburgh & Lake Erie—				
J. A. Atwood, chief engineer	6,000	6,600	......	......
A. R. Raymar:				
Assistant chief engineer and signal engineer	5,000	5,600	......	......
Chief engineer	......	......	7,083	4,250
E. W. Boots:				
Assistant engineer	4,500	4,500	......	......
Engineer, maintenance of way	......	......	4,833	2,900

Name and Titles of Employees	Amount of Compensation: Year Ended Dec. 31, 1914	Year Ended Dec. 31, 1917	10 Months March 1 to Dec. 31, 1920	6 Months Jan. 1 to June 30, 1921
Rutland:				
J. G. Shillinger, chief engineer	4,000	4,000	3,600	......
L. G. Murphy, chief engineer	......	......	......	2,379
Pennsylvania—				
E. W. Smith, engineer of transportation	......	......	5,035	3,021
A. C. Shand, chief engineer	11,523	11,510	11,620	6,972
E. B. Temple, assistant chief engineer	6,547	7,063	7,747	4,648
H. C. Booz, assistant chief engineer	6,547	7,063	......	......
R. Thimble, assistant chief engineer	......	......	7,803	3,990
J. F. Murray:				
Assistant chief engineer	......	......	7,747	4,648
Assistant to chief engineer	4,539	5,493	3,873	......
S. A. Sloan, assistant to chief engineer	......	......	......	2,324
N. F. Brown, assistant to chief engineer	......	......	3,873	1,103
G. Nauman, assistant to chief engineer	......	......	3,873	2,324
G. C. Koons, assistant to chief engineer	......	......	4,067	2,440
E. G. Ericson, assistant to chief engineer	......	......	3,901	1,995
H. C. Crowell, assistant to chief engineer	......	......	3,511	1,103
B. V. Sommerville, assistant to chief engineer	......	......	4,682	2,394
H. R. Leonard, engineer bridges and buildings	7,857	8,371	7,747	4,648
J. C. Bland, engineer bridges and buildings	......	......	7,803	3,990
R. Farnham, Jr., assistant engineer bridges and buildings	......	4,447	4,519	2,711
W. C. Cushing, engineer standards and valuation	......	......	4,519	3,873
W. G. Coughlin, chief engineer maintenance of way	6,809	7,249	7,472	4,483
A. B. Clark, assistant chief engineer, maintenance of way	4,976	......	......	......
C. N. Neimeyer, assistant chief engineer, maintenance of way	......	5,307	4,903	980
G. C. Koons, assistant chief engineer, maintenance of way	4,976	5,388	......	......
G. H. Brown,assistant chief engineer, maintenance of way	......	......	4,903	2,942
J. T. Richards, consulting engineer, maintenance of way	6,285	......	......	......
A. H. Rudd, signal engineer to engineer maintenance of way	4,976	5,436	......	......
H. S. Hayward, consulting engineer of floating equipment	4,976	......	......	......
C. A. Preston, valuation engineer	6,547	7,063	6,455	3,873
J. W. Stone, assistant valuation engineer	......	......	3,486	2,091
W. A. MacCart, engineer	......	......	......	2,068
A. B. Cuthbert, engineer maintenance of way	......	5,400	......	......
C. E. Bruiser, engineer maintenance of way	......	......	5,250	3,150
E. Irvin, division engineer	......	......	3,560	2,670
N. S. Pitcairn, division engineer	......	......	3,560	2,670
J. H. Harris, engineer, maintenance of way	......	1,533	4,511	2,683
G. P. Miller, engineer, maintenance of way	......	3,067	......	......
James Miliken, special engineer	......	3,483	......	......
F. B. Davis, division engineer	......	......	4,330	2,670
J. H. Nichol, engineer, maintenance of way	......	......	......	1,000
C. H. Neimeyer, engineer, maintenance of way	......	5,100	5,000	2,100
F. Duane, engineer, maintenance of way	......	......	4,191	3,150
J. C. Auten, engineer, maintenance of way	......	1,337	......	......
W. F. Miller, division engineer	......	......	3,560	2,670
S. L. Church, division engineer	......	......	3,560	2,670
M. Lipman, division engineer	......	......	3,560	2,670
W. D. Wiggins:				
Chief engineer maintenance of way	......	......	......	1,115
Valuation engineer	......	......	5,465	......
W. E. Brown:				
Assistant chief engineer maintenance of way	......	......	......	2,316
Assistant valuation engineer	......	......	3,783	......
A. A. Wirth, assistant valuation engineer	......	......	1,844	......
R. T. Colbert, engineer, maintenance of way	......	1,001	5,250	3,150
G. W. Snyder, engineer, maintenance of way	......	4,398	......	......
R. Farries, division engineer	......	......	4,100	2,670
C. P. McArthur:				
Engineer, maintenance of equipment	......	......	5,000	3,000
Engineer maintenance of way	......	5,100	......	......
W. F. Fuignon, division engineer	......	......	3,440	......
J. B. Baker, engineer, maintenance of way	......	......	5,000	3,000
W. R. Hillary, engineer maintenance of way	......	......	4,491	1,125
Pennsylvania Company—				
Thomas Rodd, chief engineer	8,971	10,838	......	......
W. C. Cushing, chief engineer maintenance of way	5,024	......	......	......
Robert Trimble:				
Chief engineer maintenance of way	......	8,900	......	......
Asssistant chief engineer	5,024	......	......	......
J. D. Esposite, assistant engineer	2,990	......	......	......
E. G. Ericson:				
Assistant engineer	2,990	......	......	......
Principal assistant engineer	......	2,710	......	......
B. V. Sommerville, principal assistant engineer	2,990	......	......	......
J. C. Bland, engineer of bridges	4,306	4,346	......	......
W. D. Wiggins, valuation engineer	5,196	3,387	......	......
Pere Marquette—				
A. L. Grandy, chief engineer	......	1,350	......	3,360
J. Tuthill:				
Chief engineer	......	......	5,940	1,320
Assistant chief engineer	......	......	5,940	1,320
H. C. Cassil, engineer maintenance of way	......	......	......	2,520
C. S. Sheldon, engineer of bridges	......	......	......	2,520
Philadelphia & Reading—				
William Hunter, chief engineer	8,000	......	......	......
Samuel T. Wagner:				
Assistant chief engineer	5,280	......	......	......
Chief engineer	......	7,500	6,850	4,200
Clark Dillenbeck, assistant chief engineer	......	......	5,400	3,300
F. Jaspersen, assistant chief engineer	......	......	4,566	2,800
Charles Hansel, consulting valuation engineer	......	......	......	2,777
E. Y. Allen, valuation engineer	......	......	......	2,800
Frank S. Stevens, engineer maintenance of way	......	......	......	2,760
Richmond, Fredericksburg & Potomac—				
S. B. Rice, engineer, maintenance of way	......	......	4,712	2,925
St. Louis-San Francisco—				
F. G. Jonah, chief engineer	10,000	8,916	9,716	6,350
C. B. Spencer, valuation engineer	......	......	4,975	3,075
W. H. V. Rosing, special engineer	6,000	6,000	......	......
H. B. Barry, assistant engineer	......	......	4,475	2,775
R. E. Miller, bridge engineer	3,000	3,300	4,195	2,595
Southern Pacific Lines—				
J. D. Isaacs, consulting engineer	12,000	12,500	11,666	7,500
C. R. Harding, assistant consulting engineer	......	3,280	5,000	3,000
R. C. Watkins, corporate engineer	......	......	6,250	3,750
G. W. Boschke, chief engineer	14,000	14,000	12,500	7,500
J. H. Wallace, special engineer	......	......	1,916	2,700
W. H. Kirkbride, engineer maintenance of way and structures	8,500	8,500	8,333	5,000
W. M. Jaekle, assistant engineer maintenance of way and stations	8,400	8,400	6,250	3,750
H. M. Lull, chief engineer	4,867	6,350	6,000	3,600
R. W. Barnes, constructing engineer	6,100	......	3,655	2,550
John Lansdale, valuation engineer	......	4,750	4,350	3,000
St. Louis Southwestern—				
C. D. Purdon:				
Chief engineer	4,500	4,775	......	......
Valuation engineer	......	......	5,000	3,000
A. A. Matthews, chief engineer	......	......	5,625	2,681
W. S. Hanley, chief engineer	......	......	......	854
San Antonio & Aransas Pass—				
L. Andrews, chief engineer	......	......	4,250	2,550
Texas & Pacific—				
E. F. Mitchell, chief engineer	4,300	6,000	6,250	3,750
R. H. Gaines, engineer maintenance of way	......	......	4,775	3,000
R. H. Jones, valuation engineer	......	4,800	4,400	2,700
Toledo, St. Louis & Western—				
F. R. Ramsey, chief engineer	......	......	5,150	3,300
Virginian—				
H. Fernstrom, chief engineer	10,000	10,000	9,666	6,000
A. M. Traugott, assistant chief engineer	......	......	5,300	3,300
F. F. Harrington, engineer of structures	3,000	3,600	4,800	3,000
Wabash—				
R. H. Howard, chief engineer maintenance of way	......	5,400	6,175	3.750
A. O. Cunningham, chief engineer	5,000	5,600	6,175	3,750
Western Pacific—				
T. J. Wythe, chief engineer	7,000	7,166	8,333	5,000
Wheeling & Lake Erie—				
W. L. Rohbock, chief engineer	4,000	4,166	5,130	3,150
John Sesser, engineer maintenance	......	......	......	1,895
W. B. Thomson, valuation engineer	2,300	2,500	4,033	2,500

The application of the Pennsylvania Railroad and the Mountain Water Supply Company and the Dunbar Water Supply Company, its subsidiaries, for an injunction prohibiting 29 individual, partnership and corporation coal owners from draining water discharged from their mines into Indian Creek has been dismissed in the Court of Common Pleas of Fayette County, Pennsylvania Properties estimated to be worth more than $25,000,000 are involved in the case which, it is expected, will now go to the United States Supreme Court for final decision. The court, in its decree, points out that the water flows from the mines by gravity and through crevices or breaks in the rock is discharged into Indian Creek. From its contact with the sulphur in the coal measure and oxygen in the air, the water is highly charged with sulphuric acid, and when used for steam making in locomotive or stationary boilers quickly destroys the boiler tubes and any metal with which it comes in contact, and holds that the railroad and its water companies, should the injunction be granted and sustained, would put the coal owners out of business, while the cost of treating the water by the railroad is not exorbitant.



This department is an open forum for the discussion of practical problems of engineering and maintenance of way. Readers are asked to send in any questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. *Railway Engineering and Maintenance* also solicits the co-operation of its readers in answering any of the questions listed below.

The following questions will be answered in next month's issue:

(1) Is it preferable to extend a water supply line to a storage tank above the level of the tank bottom, and, if so, is it more economical to project it through the tank or carry it up on the outside?

(2) What are the relative advantages of the drop hammer and the steam hammer?

(3) What thickness of plank is most economical for highway crossings?

(4) To what extent is it practicable to replace bunk cars with portable camps to house extra gangs?

(5) Is the shop painting of structural steel for bridge, building and tank work always desirable?

(6) How far away from the tracks should snow fences be placed for the best results?

(7) What measures are necessary to keep expansion bearings on steel bridges in condition for free movement?

(8) Is rope preferable to chain for pulling down road side tank spouts and opening the tank valve?

Protecting Pipes Penetrating Walls

What protection should be provided for pipe lines passing through concrete piers or foundation walls?

First Answer

Where the pipes are of small section, no precautions need be taken, but where the pipes are 12 in. and over and foundation pressures are considerable, reinforcement shall be so placed as to transfer the foundation pressures to the adjacent concrete. No reinforcement should be placed less than 3 in. from any pipe.

M. Hirschthal,
Concrete Engineer, Delaware, Lackawanna & Western, Hoboken.

Second Answer

The precautions necessary will depend on local conditions, first, as to the size and kind of pipe, second, reliability of the foundation settling and the varying temperature in the pipe which would cause expansion and contraction.

In the case of cast iron pipe which is comparatively unyielding, generally speaking, it is advisable to provide an opening in the concrete considerably larger than the diameter of the pipe to allow for both settlement of the wall and expansion of the pipe. Provision should also be made to ram the back-filling adjacent to the wall or pier so that excessive settlement of the filling will not break the pipe. That is necessary of course only where there is a deep fill over the pipe on either side.

Small wrought pipe can be incorporated into the wall with safety by providing expansion or swinging joints on one or both sides as local conditions may require, but even with small wrought pipe it is preferable to provide an opening through the wall considerably larger than the pipe. If necessary the opening around the outside of the pipe can be closed with suitable packing.

A. H. LaFountain,
General Supervisor of Buildings, Chicago, Milwaukee & St. Paul, Chicago.

The Use of Hooks in Handling Treated Timber

To what extent is it practicable to eliminate the use of cant hooks, carrying hooks and dogs from the equipment of bridge gangs using treated timber?

First Answer

The use of carrying hooks can be eliminated almost entirely by using stationary, live and track dollies, and if the gang foreman has had the proper education, it will not require much effort on the part of the supervisor to have him leave all carrying hooks in the tool car. The average bridge gang encounters various problems where it cannot get along without cant hooks. But when handling treated material, flat chisels and bars with about 3 in. point can frequently be used in place of cant hooks. Also rope slings and hand lines may be used.

While, therefore, it is impossible to eliminate entirely the use of cant hooks, carrying hooks, dogs and other tools of this kind from the equipment of the bridge gangs using treated timber, it is possible to curtail their

use to a great extent by providing them with other equipment which can be used to good advantage.

JOHN P. WOOD,
Supervisor Bridges and Buildings, Pere Marquette, Saginaw, Mich.

Second Answer

It is not practicable to eliminate entirely the use of cant hooks, carrying hooks and dogs in handling of treated or any timber of large dimensions, but it is very essential to modify the design of hooks so that they will not injure the outer surface of timber which has been treated.

The cant hook could be designed in several ways. One method is to use the present type of hook and handle but instead of a spur on the hook to use a flat plate of iron set at an angle. In this case a special hook would be required for each size timber to prevent slipping. A cant hook for more universal use could be constructed that would not injure the timber by following closely the design of the ordinary chain pipe tongs. The timber carrying hooks should be constructed similar to the present type but hooks should be made long enough and arched enough to span the timber and should be provided with a flat surfaced hook to catch under the timber instead of hooking into it. Timber dogs with spikes should not be used and are seldom required in bridge work, but when needed, a friction clamp should be substituted that will grip both sides of the timber like a pair of tongs and tighten when pulled to such a degree that they will not slip.

S. C. TANNER,
Superintendent of Shops, Baltimore & Ohio, Martinsburg, W. Va.

The Cost of Ballasting Track

How many man hours are required to ballast with gravel a mile of track previously unballasted, where the roadbed has been restored to standard section in advance, the work to include the skeletonizing of the track to the bottom of the ties, the spacing of the ties and the renewal of 25 per cent of them, the track to be gaged and expansion adjusted and to be given a raise of eight inches, well tamped and dressed to standard ballast section, ditches to be cleaned and old ties burned?

First Answer

Any figures on the number of man hours required in ballasting track are at best but an approximation owing to the many factors which enter into the work. Observations made on a certain southwestern road several years ago, supplemented by figures taken from some 1921 records of ballasting with fairly coarse material, lead me to place the figure at 5,025, where average labor, traffic and physical conditions prevail. The tabulation will show how the figure was determined.

Stripping mud ballast section	600 man hours
Gaging, spacing and renewing (25 per cent) ties (new ties previously distributed)	750 man hours
Adjusting rail expansion (this usually not necessary on every mile and the figures intended only for simpler method such as cutting a pair of rails at foot of hills and putting in longer rails at summits with minimum driving)	25 man hours
Lifting 8 in. on gravel, side unloading, with 10 per cent stones from 2¼ in. to large boulders	1,800 man hours
Resurfacing and final lining	350 man hours
Trimming, cleaning ditches, burning old ties, covering boulders in sub-grade, etc	1,500 man hours
Average gravel yardage (2,700).	
Total man hours, one mile of track	5,025

Naturally, values for lifting and trimming are reduced directly with the size of the ballast, making any representative estimate difficult to obtain. The figure given, however, may be taken as a fairly correct average for good gravel.

Center dump cars used in conjunction with Hart side dump cars will also reduce values but in arriving at the value given, I have considered only the average conditions usually met rather than what might be done. The figure on the renewal is somewhat higher than our actual work gives. It is based on an estimate of 10 ties to a man per day. Gangs of 65 to 70 men on our line have made over 1,000 renewals in a day, but in all cases soft wood ties were used. The figure given for the renewal is also larger by reason of including the items of gaging and spacing with it.

ENGINEER OF TRACK.

The Superelevation of Simple Curves

In surfacing a simple curve without spirals, where should the superelevation be started? Is it preferable to provide half or full superelation at the point of curve and point of tangent?

First Answer

The superelevation of a curve without spirals should be started at a point back on the tangent so that half of the full superelevation will be obtained at the point of curve and point of tangent, running the elevation out (for example, say 1 in. in 40 ft.) in conformity with the particular standard employed. This method is preferable to that of beginning and ending superelevation at the points of curve and tangent. Main line curves stiffer than one degree should be spiraled, especially where fast speed is maintained.

J. P. ANDERSON,
Assistant Engineer, Nashville, Chattanooga & St. Louis, Atlanta, Ga.

Second Answer

Before the use of spirals became prevalent the track was carried level to the point of curve and then given the elevation from there on. It would undoubtedly have been better to have commenced the superelevation on the tangent. Trackmen would probably have done this had they been as familiar with what happens when curves are spiraled as they are now. It is much better to provide about one-half the superelevation at point of curve, in the case of simple curves which have not been spiraled at the ends.

H. A. CASSIL,
Chief Engineer, Pere Marquette, Detroit, Mich.

Third Answer

The practice on the Chicago & Northwestern is to carry the full superelevation throughout the curve and have the run-off entirely on the tangent. Theoretically, of course, a reduction of superelevation in order to have the run-off partly on the curve produces an instantaneous reversal of lateral force acting on the car at the point of curve and point of tangent. However, as nearly all curves have a "trackman's spiral" at their ends and consequently elbow a little ways inwardly on the curve and as different trains have different speeds, the superelevation, curvature and speed are incapable of exact balance. Therefore, rigid refinements are impossible and our method secures as good a practical result as is obtainable under the circumstances.

C. T. DIKE.
Engineer of Maintenance, Chicago & North Western, Chicago.

Fourth Answer

For simple curves not having spiral ends, the full elevation should be extended to the end of the curve, from where it should run out gradually on the tangent to a level with the inner rail by reducing the elevation

of the outer rail ½ in. to each thirty-foot rail length, except in cases where the tangents are too short to permit it.
F. G. JONAH.
Assistant to President and Chief Engineer, St. Louis-San Francisco, St. Louis, Mo.

The Use of Sawdust in Ice Houses

To what extent should sawdust be used for packing the ice in ice houses and in what manner, in general, should it be employed?

Sawdust should not be used for the packing of ice in ice houses for the following reasons:

(1) The resultant saving of ice does not warrant the expense of handling. (2) Special space has to be provided for the storage of sawdust, which is also an unnecessary expense. (3) Due to the proximity of locomotives, there is always more or less vibration and this condition causes the sawdust to settle and pack, capillary attraction is then set up and the effectiveness of the sawdust is destroyed. (4) More or less sawdust clings to ice taken from storage, and if the ice is not washed, this sawdust has a tendency to clog the drains of the refrigerator car. If the ice is washed, any saving in shrinkage on account of packing in sawdust is reduced. (5) The ice house must be cleared of all sawdust before the next season's store of ice is put in, incurring an extra expense for the clearing. (6) Ice houses should be supplied with drains. If sawdust is used for packing, these drains become clogged and only add to the expense, as the drains have to be kept open. (7) The main function of packing sawdust in ice is to avoid the circulation of air around the ice. This can readily be done by covering the ice with oiled paper, and then covering it with two feet of hay or straw. When the ice is taken out of storage the hay or straw can easily be moved, together with the paper with very little extra expense for handling the ice.

FRANK R. JUDD,
Engineer of Buildings, Illinois Central, Chicago.

Anchoring Rail on Long Trestles

Supplementing a question in the October issue, is it permissible to use anti-creepers on long pile or timber trestles? If so, what precautions, if any, should be observed?

First Answer

We have used anti-creepers on some of our long trestles with good results. These anti-creepers are always placed against those ties which are bolted to the structure, or in the case of trestles, against the ties which are secured to the stringers by line spikes. We have had very little trouble with them after they are installed.

C. S. HERITAGE,
Bridge Engineer, Kansas City Southern, Kansas City, Mo.

Second Answer

This road has never installed anti-creepers on continuous long pile or wooden trestles, and therefore have no experience in the matter. Personally, I should consider it impracticable to use anti-creepers either on timber trestles or on open deck steel bridges, owing to the difficulty of holding the deck. It would be my decided preference to omit the anti-creepers on these structures and to anchor the rail securely at points beyond the end of the structure.
E. A. FRINK,
Principal Assistant Engineer, Seaboard Air Line, Norfolk, Va.

[Note—Answers to the questions on sheathing walls and laying pipe underground, also further answers to questions discussed in this month, will be published next month, space limitations having necessitated their ommission in this issue.—Editor.]

Maintenance of Way Club of Chicago

The next meeting of the Maintenance of Way Club of Chicago will be held at the rooms of the Western Society of Engineers, Monadnock building, Chicago, on February 20, beginning at 7:30 p. m. The speaker of the evening will be J. D'Esposito, chief engineer of the Chicago Union Station Company, who will give a talk on the special track construction and concrete track foundation which is being provided for the track in the Union Station and approaches.

Metropolitan Track Supervisors' Club

Earl Stimson, chief engineer, maintenance of way, Baltimore & Ohio, Baltimore, Md., was the principal speaker at the last regular meeting of the Metropolitan Track Supervisors' Club at the Hotel Martinique, New York, on January 13. Mr. Stimson discussed the labor situation which was likely to confront the country in relation to the use of labor-saving equipment. He stressed upon the need of active co-operation of the supervisors and roadmasters in educating their foremen to use intelligently and economically equipment that was already on hand and to prepare them for future equipment which might be ordered. C. A. Joyce, supervisor of track, Erie, Paterson, N. J., gave a talk on the Cleaning of Ballast by Mechanical Means, wherein he outlined some of the classes of equipment now in use and the methods by which they are operated. The meeting was well attended, there being a total of 54 members and others present.

New York Section of Bridge and Building Association

The New York Section of the American Railway Bridge and Building Association held a meeting on January 30, which included an inspection of the progress of work on the New York-New Jersey vehicular tunnel now under construction, a dinner and a business meeting in the evening. Following the business meeting an illustrated talk on Vehicular Tunnel Construction was presented by Clifford M. Holland, chief engineer of the project. Herbert C. Keith, consulting engineer, New York City, is secretary of the New York Section.

American Railway Engineering Association

The Nominating committee of the association has presented the names of the following members as candidates for election for the ensuing year:

President: E. H. Lee, vice-president, C. & W. I., Chicago.
Vice-president (one to be elected): J. M. R. Fairbairn, chief engineer, C. P. R., Montreal, Que., and Edwin B. Katte, chief engineer, electric traction, N. Y. C., New York City.
Secretary: E. H. Fritch, Chicago.
Treasurer: George H. Bremner, engineering department, C. B. & Q. La Grange, Ill.
Directors (three to be elected): J. R. W. Ambrose, chief engineer, Toronto Terminals Railway, Toronto, Ont.; G. D. Brooke, superintendent transportation, B. & O. Western Lines, Cincinnati, Ohio; W. T. Dorrance, designing engineer, N. Y., N. H. & H., New Haven, Conn.; W. J. Eck, signal and electrical superintendent, Sou., Washington, D. C.; W. D. Faucette, chief engineer, S. A. L., Norfolk, Va.; C. E. Johnston, general manager, K. C. S., Kansas City Mo.; W. H. Kirkbride, engineer maintenance of way and structures, S. P., San Francisco, Cal.:

F. J. Stimson, chief engineer maintenance, Southwestern region, Pennsylvania, St. Louis, Mo., and Louis Yager, assistant chief engineer, N. P., St. Paul, Minn.

Members of Nominating Committee (five to be elected): C. W. Baldridge, assistant engineer, A. T. & S. F., Chicago; W. J. Burton, assistant valuation engineer, M. P., St. Louis, Mo.; W. A. Clark, chief engineer, D. & I. R., Duluth, Minn.; C. E. Denney, vice-president and general manager, N. Y. C. & St. L., Cleveland, Ohio; J. L. Haugh, assistant to president, U. P., Omaha, Neb.; F. H. McGuigan, Jr., regional engineer, U. S. R. A., Chicago; J. V. Neubert, engineer maintenance of way, N. Y. C., New York City; W. H. Penfield, engineer maintenance of way, C. M. & St. P., Chicago; J. A. Peabody, signal engineer, C. & N. W., Chicago, and H. N. Rodenbaugh, general manager, F. E. C., St. Augustine, Fla.

Roadmasters' Association

The following members have been selected by the Executive committee for service on the various standing committees during the ensuing year:

Maintenance of Large Yards and Yard Tracks—Chairman, R. W. E. Bowler, Penna., Washington, D. C.; D. C. McGregor, B. & O., Pittsburgh, Pa.; George Brooks, Terminal Railroad Association of St. Louis, St. Louis, Mo.; J. B. Kelly, M. St. P. & S. S. M., Minneapolis, Minn.; D. O'Hern, E. J. & E., Joliet Ill.; M. Ganley, A. T. & S. F., Argentine, Kan.; M. J. Griffin, C. R. R. of N. J., Jersey City, N. J.; C. T. Kimbrough, I. H. B., Gibson, Ind.; W. Hogan, B. & O. C. T., Chicago.

Training of Section Foremen—Chairman, S. E. Shoup, K. C. S., Kansas City, Mo.; J. P. Costello, A. T. & S. F., Pueblo, Colo.; E. C. Buhrer, T. & O. C., Kenton, Ohio; Thomas Gallagher, S. P., Los Angeles, Cal.; D. C. Buell, Omaha, Neb.; N. McNabb, M. C., Niles, Mich.; H. Ferguson, G. T., Toronto, Ont.; E. J. Haley, A. C. L., Portsmouth, Va.; E. Boland, I. C., Freeport, Ill.; A. Salinsky, B. R. & P., Punxsutawney, Pa.

Continued Study of Labor Saving Devices—Chairman, W. C. Carpenter, Erie, Croxton, N. J.; William Shea, C. M. & St. P., Chicago; B. F. Hanna, B. & O., Rockwood, Pa.; W. E. Davin, P. & L. E., Pittsburgh, Pa.; F. H. Hanson, N. P., Grand Forks, N. D.; J. M. Fair, Penna., Philadelphia, Pa.; A. W. Tabert, C. & N. W., West Allis, Wis.; W. Lawrenz, C. & E. I., Dolton, Ill.; G. W. Morrow, N. Y. N. H. & H., New Haven, Conn.; E. P. Safford, N. Y. C., Silver Creek, N. Y.; T. Thompson, A. T. & S. F., Joliet, Ill.; J. W. Dahl, N. Y. C., Lockhaven, Pa.; A. M. Clough, N. Y. C., Batavia, N. Y.

Rail Laying and Ballasting Track Under Single Operation—Chairman, R. G. Knight, N. P., Tacoma, Wash.; John Barth, C. C. C. & St. L., Mattoon, Ill.; P. M. Dinan, L. V., Geneva, N.Y.; M. J. Deltgen, C. & N. W., Clinton, Ia.; G. W. Kohn, C. R. I. & P., Joliet, Ill.; F. B. Adams, P. & R., Pottsville, Pa.; John Sexton, D. L. & W., Hopatcong, N. J.; C. C. Metzger, Erie, Lima, Ohio; E. Keough, C. P. R.. Montreal, Que.; H. S. Clark, D. & H., Carbondale, Pa.

Standard Maintenance of Single Track Lines—Chairman, E. P. Hawkins, M. P., Osawatomie, Kan.; E. W. Gulley, C. R. I. & P., Enid, Okla.; J. W. Ellis, St. L.-S. F., Chaffee, Mo.; D. V. O'Connell, C. & N. W., Lusk, Wyo.; J. F. Butcher, F. C. I. D. c. D. A., Guatamala, Central America; J. H. Gross, St. Paul, Minn; F. M. Barnoske, C. M. & St. P., Ottumwa, Ia.; P. Burns, C. M. & St. P., Marmarth, S. D.; J. R. Branley, M. St. P. & S. S. M., Crosby, Minn.; William McGregor, M. St. P. & S. S. M., Minneapolis, Minn.

Discussion of railway terminal development in Chicago has been given renewed impetus by the presentation of plans for a new project by the Chicago & Western Indiana. In general, the plan provides for a new passenger station located on Polk street and extending from State to Clark street and a freighthouse development south of the passenger station to accommodate the roads now using freight facilities located on the Chicago & Western Indiana terminal. In case of participation in this project by the roads now using the La Salle street station freight facilities could be provided for these roads also. The plan embraces a comprehensive street plan covering the entire terminal area, the predominating feature of which is the extension of Dearborn street southward across the terminal area as a through artery with a boulevard width of 120 ft. It is understood that plans for extensive terminal development are also being prepared by the Chicago, Rock Island & Pacific, the New York Central, and the Baltimore & Ohio. Owing to the attitude of the public authorities in Chicago toward electrification, it is anticipated that all plans will provide for the eventual electrification of all the roads which may use the proposed terminals.

The Material Market

THE MARKET in the iron and steel industry is characterized by increasing activity in structural material and wire products and moderate business in track materials. This is reflected in the prices. Almost no changes have taken place in the prices for track spikes, bolts, angle bars and tie plates, whereas a notable increase has taken place in most of the other items. Thus, in the case of wire products, the independent manufacturers have definitely marked up their prices, while the existing scale still maintains in so far as it concerns the United States Steel Corporation. There has been a general improvement in the output of iron and steel, but in some lines the manufacturers are sold up for several months in advance. The United States Steel Corporation, on the other hand, has a slightly smaller tonnage of unfilled orders than was the case two months ago, but this reflects increased production rather than decreased demand. There is some tendency toward anxiety concerning the possibility of a runaway market ending in a buyers' strike such as occurred in 1920. This can be prevented if buyers will refrain from placing orders beyond actual requirements.

Prices in Cents Per Pound

	December 29		January 25	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	\$.... \$2.75	\$2.85 to \$3.00	\$.... \$2.75	\$.... \$3.00
Track bolts	3.75 to 4.50	3.85 to 4.00	3.75 to 4.25	3.85 to 4.00
Angle bars	.... 2.75	.... 2.75	.... 2.75	.... 2.75
Tie plates, steel	2.35 to 2.50	.... 2.35	.... 2.45	.... 2.45
Tie plates, iron	....	.... 2.50	....	.... 2.50
Plain wire	.... 2.45	.... 2.79	2.45 to 2.60	2.79 to 2.94
Wire nails	.... 2.70	.... 3.04	2.70 to 2.80	3.04 to 3.14
Barbed wire, gal.	.... 3.35	.... 3.69	3.35 to 3.45	3.69 to 3.79
C. I. pipe, 6 in. or larger, per ton	....	.... 51.20	....	.... 51.20
Plates	.... 2.00	2.10 to 2.30	2.00 to 2.10	2.20 to 2.30
Shapes	.... 2.00	2.10 to 2.20	2.00 to 2.10	.... 2.20
Bars, soft steel	.... 2.00	2.00 to 2.10	2.00 to 2.10	2.10 to 2.20
Open hearth rail per gross ton f. o. b. mill				43.00

Using the scrap prices as an index in market conditions, it would seem that the iron and steel business is still on a definitely upward trend.

Prices Per Gross Ton at Chicago

	December	January
Relaying rails	\$32.00 to \$35.00	\$32.00 to \$35.00
Rerolling rails	18.50 to 19.00	20.50 to 21.00
Rails less than 3 ft. long	20.00 to 20.50	22.50 to 23.00
Frogs and switches cut apart	17.75 to 18.00	19.25 to 19.75
	Per Net Ton	
No. 1 railroad wrought	15.50 to 16.00	18.00 to 18.50
Steel angle bars	17.00 to 17.50	19.00 to 19.50

Even greater is the upward trend in the lumber market. Sles of Southern pine by the subscriber mills of the Southern Pine Association for the week ending January 19 totaled 126,900,000 ft. b. m., the highest record in the history of the association. Sales of Douglas fir at the present time also average considerably higher than for some time in the past. These conditions are reflected in the price of Southern pine, although no appreciable change has taken place during the last month as in the case of Douglas fir.

Southern Mill Prices

	December	January
Flooring, 1x4, B. and B., flat	\$51.10	\$51.20
Boards, 1x8, No. 1	38.30	39.45
Dimension, 2x4, 16, No. 1, common	30.35	30.70
Dimension, 2x10, 16, No. 1	.....	29.85
Timbers, 4x10 to 8x8, No. 1	27.50	28.50
Timbers, 3x12 to 12x12, No. 1	30.30	32.75
Douglas Fir Mill Prices		
Flooring, 1x4, No. 2, clear, flat	39.00	39.00
Boards, 1x6, 6 to 20, No. 1, common	15.00	15.00
Dimension, 2x4, 16, No. 1, common	20.50	20.50
Dimension, 2x10, 16, No. 1, common	21.50	21.50
Timbers, 6x6 to 8x8, No. 1, common	18.00	18.00
Timbers, 10x10 to 12x12, rough	20.00	22.00

No changes have taken place in the prices of portland cement during the last month. Current prices per barrel in carload lots, f. o. b. middle western cities are as follows. These prices do not include package:

Chicago	\$2.05	Duluth	\$2.04
Cincinnati	2.39	Milwaukee	2.22
Davenport	2.28	Minneapolis	2.29
Detroit	2.33	Pittsburgh	2.14

General News

The Maryland, Delaware & Virginia and the Baltimore, Chesapeake & Atlantic, subsidiaries of the Pennsylvania, are to be sold under foreclosure proceedings. It is likely the roads will be purchased by the Pennsylvania.

A new railway line is planned from Oex, Switzerland, on the Bellgarde-Chamonix line, to Aosta. The work involves 13 tunnels and 13 bridges. The longest of the tunnels, 46,100 ft., will be through Mont Blanc and will require four or five years in its completion.

The Nashville, Chattanooga & St. Louis celebrated its seventy-fifth anniversary on January 24, this anniversary being made the occasion of numerous public addresses by the president and other officers of the road, with a view to promoting better relations between the railroad and the public.

In a decision handed down by the Supreme Court of the District of Columbia on January 4, involving the St. Louis Southwestern, it was held that a railroad cannot compel the Interstate Commerce Commission to permit it to examine the records of the Bureau of Valuation on the grounds that such records are not public.

The New York Central detailed more than 100 locomotives for snow plow work in New York during the first two weeks of the new year owing to the heavy snowfall in the upper portion of the state. A. H. Smith, president of the road, stated that more snow fell during this period than in any corresponding period since 1874.

The Van Sweringen interests of Cleveland, who at present are in control of the New York, Chicago & St. Louis, the Toledo, St. Louis & Western and the Lake Erie & Western, have secured in addition a large interest in the Chesapeake & Ohio -hrough the purchase from H. E. Huntington and his associates of their holdings in the latter company.

The Michigan Central is now conducting negotiations with the various municipal and governmental authorities for the approval of plans for a new 640-ft. arch to replace the cantilever bridge over the Niagara gorge built in 1883. The proposed bridge will occupy a location between the present Michigan Central cantilever bridge and the 550-ft. arch bridge owned by the Niagara Suspension Bridge Company and the Niagara Falls International Bridge Company, but commonly known as the Grand Trunk arch.

Argument in the first case to reach the United States Supreme Court involving the power of the United States Railroad Labor Board under the Transportation Act was heard on January 11. This concerned the appeal of the Pennsylvania Railroad to restrain the Labor Board from interfering with an election of employee representatives, from declaring void the contracts between the company and its employees and from publishing an opinion that the company had violated Labor Board decisions. The case reached the Supreme Court on an appeal by the company from a decision of the Circuit Court of Appeals, which had reversed a decision of the district court granting a permanent injunction against the board.

The American Society of Civil Engineers in its annual meeting on January 17, 18 and 19, at the Engineering Societies building, New York City, elected C. F. Loweth, chief engineer, Chicago, Milwaukee & St. Paul, Chicago, as president, and R. N. Begien, general manager, lines west, Baltimore & Ohio, Cincinnati, Ohio, as director of District 9. The other officers elected are as follows: Vice-presidents, G. S. Davison, president, Gulf Refining Company, Pittsburgh, Pa., and Anson Marston, dean of engineering, Iowa State College, Ames, Iowa; directors: District 3, G. D. Holmes, Syracuse, N. Y.; District 5, E. B. Whitman, consulting engineer, Baltimore, Md.; District 7, G. H. Fenkell, Detroit, Mich.; District 8, T. L. Condron, consulting engineer, Chicago.

The Interstate Commerce Commission's monthly summary of reports of employees, service and compensation shows that the employment and payroll expense of Class I railroads were greater in October, 1922, than they were in any month since July, 1921, when the new classification and forms of reports were put in use. Compared with the returns for September, 1922, the total number of employees shows an increase of 95,724, or 5.6 per cent. The total compensation increased $16,778,606, or 7 per cent. In the maintenance of way and structures group the number of employees shows a decrease of 10,264.

The Interstate Commerce Commission has announced its intention to conduct an investigation involving the efficiency and economy of management of railroads, this investigation to determine whether expenditures by such carriers for the maintenance of equipment have been reasonable; the manner and method in which the business of such carriers is conducted with special reference to the furnishing of car service; whether the courses adopted by such carriers in the maintenance of equipment and in providing car service have been efficient and economical, and whether the service provided has been reasonably adequate. All railroads will be included in the investigation.

Officers of the Southern Pacific and the Union Pacific as well as most of the representatives of shippers and other organizations that are parties to the case before the Interstate Commerce Commission on the application of the Southern Pacific for authority to acquire control of the Central Pacific have signified their willingness to accept an arrangement involving terms and conditions intended to safeguard all interests in case the decision of the commission is favorable to the Southern Pacific's application. The proposed arrangement provides for rate making and interchange agreements such as will protect each road from discrimination by the other in their respective territories, prominent among which is the agreement that the Southern Pacific shall join with the Union Pacific in maintaining through passenger, mail, express and freight service between San Francisco and Chicago, via the Union Pacific route.

The Missouri & North Arkansas has been the scene of a series of disturbances incident to a protracted strike, which reached a climax recently in the lynching of a striker, the reported whipping of 20 others, the whipping of a hotel keeper who was charged with being active on behalf of the strikers and the extradition after flogging of a policeman alleged to have been in sympathy with them. The citizens of the towns along the line have participated openly in the disturbances, evincing a determination to prevent further interference with the operation of the road, which is their one means of transportation. On Monday, January 15, several hundred citizens from various points along the line congregated at Harrison, Ark., to take effective steps to protect their interests, and armed men patrolled the streets searching for strikers and endeavoring to find clues to the destruction done to railroad property. As a result of the wrecking and damaging of 10 bridges, eight strikers were placed under arrest, and a number are reported to have been convicted and sentenced to seven or more years imprisonment on charges of arson. The state government was prepared to intervene

Personal Mention

General

H. N. Rodenbaugh, chief engineer of the Florida East Coast, with headquarters at St. Augustine, Fla., has been promoted to general manager with the same headquarters, effective January 17.

George Le Boutillier, general superintendent of the Pennsylvania, with headquarters at Harrisburg, Pa., and an engineer by education and experience, has been elected vice-president of the Long Island, with headquarters at New York, where he will assist President Ralph Peters, gradually taking over his work of directing and managing the property of the Long Island Railroad. Mr. Peters is scheduled to retire from active duty in the autumn of this year. Mr. Le Boutillier was born on February 2, 1876, at Cincinnati, Ohio, and was educated at the University of Cincinnati. He entered railway service on August 1, 1895, as a rodman on the Pennsylvania, Lines West. On November 1, 1900, he was appointed assistant engineer and on July 1, 1903, division engineer. He was promoted to superintendent on February 1, 1914, and held that position until March 1, 1920, when he became general superintendent, the position he was holding at the time of his recent promotion.


George Le Boutillier

Charles F. Loweth, chief engineer of the Chicago, Milwaukee & St. Paul System, was elected president of the American Society of Civil Engineers at its annual meeting in New York, as noted elsewhere in these columns. Mr. Loweth has been a member of this association for 40 years, had served previously as a director and as a vice-president, and was a representative of the society on Engineering Council from 1918 to its dissolution. He is a past president of the Western Society of Engineers, Chicago, and of the Civil Engineers Society of St. Paul, and has served the American Railway Engineering Association as treasurer and as a director for two terms. Mr. Loweth was born at Cleveland, Ohio, on March 3, 1857, and was educated at Oberlin College, Oberlin, Ohio. He entered railway service as a rodman on surveys on the Cleveland, Lorain & Wheeling, now a part of the Baltimore & Ohio, in 1876, and later was a draftsman on the Atchison, Topeka & Santa Fe. In 1881-1882, he was engaged as an engineer in the construction of the Des Moines & Northern and the St. Louis, Des Moines & Northwestern railways (now parts of the Chicago, Milwaukee & St. Paul). The following year he served in an engineering capacity with Raymond & Campbell, bridge builders, Council Bluffs, Iowa, following which he was in consulting engineering practice in St. Paul, Minn., until 1901. During this period he served as a consulting engineer on bridge construction for the Northern Pacific, the Minneapolis & St. Louis, the Minneapolis, St. Paul & Sault Ste. Marie and the Chicago, Milwaukee & St. Paul, and as chief engineer of the South St. Paul Belt Railway and the Davenport, Rock Island & North Western. In March, 1901, he was appointed engineer and superintendent of bridges and buildings of the Chicago, Milwaukee & St. Paul, his jurisdiction being extended over the Chicago, Milwaukee & Puget Sound in March, 1906. He was promoted to chief engineer of the Chicago, Milwaukee & St. Paul in December, 1910.


Charles F. Loweth

Engineering

H. H. Richardson has been appointed engineer of water service for the Missouri Pacific, with headquarters at St. Louis, Mo., succeeding **R. C. Bardwell,** now superintendent of water supply of the Chesapeake & Ohio.

F. J. Haagen, supervisor of track on the Erie, with headquarters at Marion, Ohio, has been promoted to office engineer, with headquarters at Chicago.

T. B. Ballantyne has been appointed division engineer of the Farnham division of the Canadian Pacific, succeeding **M. Kelly,** who has been transferred to a similar position at the Toronto Terminal.

D. S. Frayer, instrumentman on the Sioux City division of the Chicago & North Western, has been promoted to assistant engineer on the Wyoming division, with headquarters at Casper, Wyo.

J. M. Nicholson, assistant engineer of tests of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., has been promoted to fuel conservation engineer, with the same headquarters.

Hugh A. Marshall, chemist for the Missouri Pacific, has been appointed chief chemist in the new created water supply department of the Chesapeake & Ohio, with headquarters at Huntington, W. Va.

E. B. Fithian, division engineer on the Missouri Pacific, with headquarters at Poplar Bluff, Mo., has been transferred to the Western district, with headquarters at Kansas City, Mo., succeeding **C. O. Congdon,** resigned.

R. M. Jolley, office engineer on the Nebraska division of the Union Pacific, has been appointed acting division engineer of the same division, with headquarters at Omaha, Neb., succeeding **T. J. Bivens,** granted leave of absence.

P. W. Elmore has been appointed assistant division engineer of the Toledo division of the Baltimore & Ohio, Western lines, with headquarters at Dayton, Ohio, in place of **G. B. Farlow,** who has been transferred to the Cincinnati terminal, succeeding **W. P. Abbott,** resigned.

C. W. Johns, engineer of construction of the Chesapeake & Ohio, with headquarters at Richmond, Va., has been promoted to the newly created position of chief engineer, with the same headquarters. **A. L. Pyle,** former assistant engineer of construction, has been appointed assistant to Mr. Johns.

H. C. Johnson, division engineer, Pennsylvania System, with headquarters at Logansport, Ind., has been transferred to the Cincinnati division, with headquarters at Cincinnati, Ohio, succeeding **F. N. Crowell,** who has been transferred to the South Bend division, with headquarters at Logansport.

W. G. Brown, engineer of roadway of the Florida East Coast, with headquarters at St. Augustine, Fla., has been promoted to engineer maintenance of way, with the same headquarters. **Calvin Oberdorf,** principal assistant engineer of construction, with headquarters at St. Augustine, has been promoted to engineer of construction.

F. J. Bratager, principal assistant engineer of the Northern Pacific, and **Louis Yager,** engineer maintenance of way, both with headquarters at St. Paul, Minn., have been appointed to the newly created positions of assistant chief engineer, with the same headquarters. **A. R. Cook,** principal assistant engineer, Lines West of Paradise, with headquarters at Seattle, Wash., has been promoted to assistant chief engineer and

engineer maintenance of way of the same lines, with the same headquarters.

Leon W. Dinsmore, assistant engineer on the Chicago, Indianapolis & Louisville, has been promoted to assistant engineer maintenance of way, with headquarters at Bloomington, Ind.

John Edward Fanning, whose promotion to district engineer of the western lines of the Illinois Central, with headquarters at Waterloo, Iowa, was noted in the January issue, was born at Buena Vista, Miss., on August 13, 1885, and received his education at the University of Mississippi. He entered railway service in June, 1905, as a transitman on the Gulf & Ship Island and was promoted to assistant engineer in April, 1907. From October, 1909, to May, 1910, he served as supervisor of track, on the latter date being promoted to assistant to chief engineer. In November, 1917, he entered the service of the Illinois Central as resident engineer, which position he held until August, 1919, when he was appointed chief engineer of the Gulf & Ship Island and the Mississippi Central during Federal control. He returned to the Illinois Central in March, 1920, as assistant engineer and in August, 1921, became roadmaster of the Iowa division, the position he held when promoted.

John Edward Fanning

Lewis H. Bond, whose promotion to assistant engineer maintenance of way of the Illinois Central and the Yazoo & Mississippi Valley, with headquarters at Chicago, was noted in last month's issue, was born at Louisville, Ky., on November 14, 1879. He entered railway service in September, 1899, as a chainman on the Illinois Central, later serving as rodman and instrumentman. From June, 1904, to December, 1905, he was an assistant engineer and from the latter date to August, 1908, served as supervisor. In August, 1908, he again became an assistant engineer and in June, 1910, was appointed roadmaster. From June, 1917, to June, 1919, he served as assistant engineer maintenance of way, on the latter date being appointed district engineer, the position he held at the date of his recent promotion.

Edward Lee Crugar, whose appointment as engineer of construction of the Illinois Central, with headquarters at Chicago, was noted in last month's issue, was born at Saline City, Mo., on November 4, 1879. Educated at Pritchett College and the University of Wisconsin, he entered railway service in June, 1900, as a chainman on the Chicago & Alton, where he later served as rodman and masonry inspector. From April, 1902, to March, 1906, he was successively chief clerk to chief engineer, resident engineer and assistant engineer of the Knoxville division of the Knoxville, La Follette & Jellico, now a part of the Louisville & Nashville, and in March, 1906, returned to the Chicago & Alton as chief clerk to chief engineer, which position he held for three years, when he was promoted to assistant engineer in charge of construction. Two years later he became assistant chief engineer and in April, 1914, was appointed assistant engineer on the Illinois Central. In December, 1916, he was promoted to district engineer, the position he held at the time of his recent appointment.

Edward Lee Crugar

Track

J. A. McGinnis, assistant roadmaster on the Canadian National, with headquarters at Tichfield, Sask., has been promoted to roadmaster, with headquarters at Avonlea, Sask.

N. C. Peterson, roadmaster on the Nebraska division of the Union Pacific, with headquarters at Fremont, Neb., has been promoted to general roadmaster of the same division, with headquarters at Omaha, Neb., succeeding **Bent Esbenson,** who has been transferred to the Los Angeles & Salt Lake Railroad as general roadmaster of the Salt Lake division, with headquarters at Salt Lake City, Utah.

N. R. Hill, whose promotion to roadmaster of the Iowa division of the Illinois Central, with headquarters at Fort Dodge, Iowa, was noted in the January issue, was born at Champaign, Ill., on May 7, 1886, and received his education at the University of Illinois. He entered railway service on June 15, 1910, as a masonry inspector on the Illinois Central and on April 15, 1913, was promoted to draftsman in the bridge department, which position he held until May 1, 1915, when he was promoted to assistant engineer. From June 15, 1921, to January 1, 1923, he served as road supervisor and on the latter date was promoted to roadmaster as noted above.

C. A. Murtaugh has been appointed track supervisor on the Erie, with headquarters at Marion, Ohio, and **Charles H. Staples,** general yard foreman, with headquarters at Hornell, N. Y., has been promoted to supervisor on the Marion and Chicago divisions, with headquarters at North Judson, Ind. Mr. Staples was born at Elmira, N. Y., on May 31, 1890, and was educated at the Elmira Free Academy. He entered railway service in 1909 as a rodman on the Delaware, Lackawanna & Western and was promoted to instrumentman in 1910, which position he held until 1913 when he was promoted to transitman. He left this road in February, 1920, to become a transitman on the Erie and in July, 1921, was promoted to assistant extra gang foreman. From December, 1921, to April 1, 1922, he was in charge of an engineering party and on the latter date was promoted to general foreman of the Hornell yard, which position he held at the time of his recent promotion.

Charles William Lentz, whose appointment as roadmaster of the Indiana division of the Illinois Central, with headquarters at Mattoon, Ill., was noted in the January issue, was born at Wetaug, Ill., on January 3, 1878, and entered railway service in 1895 as a section laborer on the St. Louis division of the Illinois Central, later serving as an assistant section foreman. In 1896, he was promoted to carpenter on the same division and in 1904 was promoted to carpenter foreman. From 1905 to 1906, he was a concrete foreman on this division, and in the latter year was appointed bridge foreman, which position he held for one year when he was appointed pile driver foreman. He returned to the position of concrete foreman in 1908 and in 1909 was promoted to general foreman bridges and buildings. He was promoted to supervisor of bridges and buildings of the Minnesota division in 1913, became bridge inspector of the system in 1916 and was promoted to chief building inspector in 1921, in which capacity he was serving at the time of his recent appointment.

Bridges and Building

J. W. Graham has been appointed bridge and building master on the Canadian National, with headquarters at Prince Albert, Sask.

James Haynes, whose promotion to supervisor of bridges and buildings on the Memphis division of the Southern, with headquarters at Sheffield, Ala., was noted in the January issue, was born at Chewalla, Tenn., on March 3, 1890. Beginning with 1908 he served in various capacities in the bridge and building department of the Southern, until July, 16, 1913, when he was promoted to bridge and building foreman, the position held at the date of his recent promotion.

Construction News

The Alabama Great Southern has awarded a contract to the McDevitt-Fleming Company, Chattanooga, Tenn., for the construction of a 70-ft. by 182-ft., three-story, reinforced concrete office building at Chattanooga, Tenn.

The Atchison, Topeka & Santa Fe contemplates the construction of two new roundhouses, a car repair shed and extensive yard improvements at Emporia, Kan., to cost approximately $5,000,000.

The Atchison, Topeka & Santa Fe contemplates the construction of a section of a third main track near Emporia, Kan., and has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of boiler washing plants at Amarillo, Tex., and Waynoka, Okla., to cost approximately $70,000.

The Canadian National, which was reported in the January issue as having authorized the construction of a cut-off from Longlac, Ont., on the Canadian Northern to Nakina, on the National Transcontinental, a distance of approximately 29.1 miles, has awarded the contract for the work to Foley Brothers & Hervey of Toronto, Ont.

The Canadian Pacific has awarded a contract to the Hurst Engineering & Construction Company, Winnipeg, Man., for the construction of an 80-ft. by 400-ft. frame freight shed at Ft. William, Ont., to replace a building recently destroyed by fire. This company has authorized improvements on its Western line, including a new passenger station at Lake Windermere, B. C.; the continuance of the lining of the Connaught tunnel on the main line, British Columbia, and the lining of a tunnel on the Crow's Nest line with concrete; the replacement of a number of wooden bridges on the Kettle Valley and on the Esquimalt and the Nanaimo with steel structures and the completion of the branch line from Okanagan Landing, B. C., to Oliver, Alta. The construction of a new terminal office building at Victoria for the British Columbia coast service is also contemplated.

Carbon County, Utah, has obtained authority from the Interstate Commerce Commission to construct a four and one-half mile line, to cost approximately $294,000.

The Chicago & Eastern Illinois contemplates the construction of a new roundhouse and shop buildings at Evansville, Ind., to cost approximately $3,000,000.

The Chicago & North Western has awarded a contract to John Marsch, Chicago, for extensions to passing tracks on the Black Hills and Wyoming divisions, including an extension of the yard at Casper, Wyo.

The Chicago & North Western has authorized grade reduction and other improvements at various points on the line between Omaha, Neb., and Casper, Wyo., and between Chadron, Neb., and Rapid City, S. D., estimated to cost approximately $2,000,000.

The Chicago & North Western contemplates the construction of a new shop building and the extension of the yard facilities at Madison, Wis. This company has awarded a contract to Roberts Brothers, Chicago, for the construction of six miles of second track between Linestone, Ill., and Radnor.

The Chicago, Burlington & Quincy expects to ask for bids about February 1 for the construction of a new double track line two miles long and a new freight and passenger station at Weston, Mo.

The Chicago, Burlington & Quincy, which was reported in the January issue as having authorized the construction of a second main track for six miles, between Sorento, Ill., and Ayres, to cost approximately $200,000, has awarded the contract to Cameron Joyce & Co., Keokuk, Iowa.

The Chicago, Milwaukee & St. Paul will construct a cut-off, approximately eight miles long, on its main line, beginning at Southeast Minneapolis and entering St. Paul from the south. The line will cross the Mississippi river on a new double track bridge which will cost over $3,000,000. Switching facilities in the new industrial district south of Minneapolis have also been planned. The new line will have a maximum grade of 0.4 per cent. The extension from the present line at St. Paul into the industrial district will be built at once.

The Chicago, Rock Island & Pacific, which closed bids on December 8, 1922, for the construction of a brick and stone passenger station at Clay Center, Kan., is now revising the plans which were made and will call for new bids in the near future.

The Chicago Union Station will close bids on February 1 for the erection of the steel work for the headhouse of the Union Station and for the furnishing of the steel for the Roosevelt road viaduct.

The Detroit & Mackinac has applied to the Interstate Commerce Commission for a certificate authorizing the construction and operation of a 12.1-mile extension from Alpena to Rockport, Mich.

The Florida East Coast has received a certificate from the Interstate Commerce Commission authorizing the construction of a line extending from Okeechobee in a general southerly direction to a connection with the main line at Lemon City, a suburb of Miami, a distance of approximately 122 miles, with a branch to a point on the Miami Canal, of about 11 miles. The proposed line will be an extension to the branch line now extending from New Smyrna, Fla., to Okeechobee. The road, except for about 10 miles at the southern end, extends through the Everglades, its main purpose being to develop the agricultural resources of that territory.

The Fort Myers Southern has applied to the Interstate Commerce Commission for a certificate authorizing the construction and operation of a 22-mile line from a point at or near Fort Myers, Fla., south to a point at or near Bonita Springs.

The Grand Trunk is preparing plans and estimates for grade separation work at Detroit, Mich., involving the expenditure of approximately $4,000,000, and expects to call for bids in the near future.

The Great Northern will construct 19 miles of second main track between Java, Mont., and Nyack, eight miles between Wheelock, N. D., and Spring Brook, and seven miles between Kandiyohi, Minn., and Atwater. Contracts for the construction in Montana have been let, but grading in North Dakota and Minnesota is not expected to begin until April.

The Illinois Central, which was reported in the January issue as planning the construction of an extension to its passenger station at New Orleans, La., has awarded the contract for this work to the Gulf Construction Company, New Orleans, La. This company has awarded a contract to the W. J. Zitterell Company, Webster City, Iowa, for the construction of a gravel washing plant at Forreston, Ill., to cost approximately $45,000, and has awarded a contract to the Adams Construction Company, Chicago, for the construction of a one-story frame passenger station in South Chicago, to cost approximately $18,000. This company has authorized the reduction of grades near Paxton, Ill., Magnet and Alma. The present grade of 0.6 per cent at Paxton will be reduced to 0.3 per cent at a cost of approximately $500,000. The 0.6 per cent grade at Magnet will be reduced to 0.3 per cent at a cost of $600,000. The 0.4 grade at Alma will be reduced to 0.3 at a cost of $125,000. This company has received authority from the Interstate Commerce Commission to acquire control by lease of the recently authorized new line of the Chicago, St. Louis & New Orleans between Dawson Springs, Ky., and Central City, and as incidental thereto and constituting part of the proposed new line, to acquire by purchase a 9.11-mile line of the Kentucky Midland extending from Central City. It is proposed to extend this to a point on the partially completed Dawson-Providence branch about 4 miles north of Dawson Springs, a distance of 25.2 miles, and to complete the Dawson-Providence branch between the point of connection and Dawson Springs, thus forming a second line from Dawson Springs to Central City.

The Illinois Central has awarded a contract to A. Guthrie, St. Paul, Minn., for the grading of 38 miles of second track

from Central City, Ky., to Dawson Springs, and has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a new freight house and passenger station at Covington, Ky., to cost approximately $75,000.

The Indianapolis Union contemplates the elevation of a portion of its tracks in the city of Indianapolis, Ind.

The Long Island has been ordered by the Transit Commission of New York to eliminate grade crossings between Jamaica, Queensborough, New York City, and the eastern boundary of the city. The work called for involves seven highway grade crossings.

The Minneapolis & St. Louis, jointly with the city of Fort Dodge, Ia., contemplates the construction of a reinforced concrete viaduct to cost approximately $36,000.

The Missouri, Kansas & Texas, which was reported in the January issue as receiving bids for the construction of a six-stall addition to the roundhouse and a new power house at Franklin, Mo., has awarded the contract to Joseph E. Nelson & Sons, Chicago.

The Missouri Pacific will close bids on February 2 for the construction of a 147-ft. by 201-ft. brick machine shop at Ewing avenue, St. Louis, Mo.

The Missouri Pacific contemplates the construction of a four-story, brick hospital at Little Rock, Ark., to cost approximately $450,000. This company closed bids on January 26 for the construction of a 26 ft. by 160 ft., one-story frame freight house at Winnsboro, La.

The Missouri Pacific, reported in the January issue as planning the construction of an addition to the passenger station at Council Grove, Kan., has awarded the contract to A. F. Morris, Kansas City, Mo. This company jointly with the city of St. Louis and the Terminal Association of St. Louis, will construct a reinforced concrete viaduct at Fourteenth street, St. Louis, Mo., which will cross the tracks of the Missouri Pacific and the Terminal Association. The construction is in charge of L. R. Bowen, chief engineer, bridges and buildings, city of St. Louis .

The New York Central contemplates the construction of a subway south of Toledo, Ohio, to eliminate a grade crossing.

The Northern Pacific contemplates the construction of a boiler shop at Livingston, Mont., reported to cost approximately $150,000.

The Okmulgee Northern contemplates the construction of 25 miles of line from Okmulgee, Okla., to Checota.

The Pennsylvania has closed bids for the construction of a new highway bridge at Garver's Ferry, Pa., on the Conemaugh division, involving 750 cu. yd. of masonry, and the erection of 163,000 lb. of new and second-hand structural steel.

The Pennsylvania has awarded a contract to H. S. Kerbaugh, New York, for excavations at its Summit avenue station, Jersey City, N. J., necessary for the construction of an additional platform. The amount of excavation is estimated at 23,000 cu. yd. and the cost at $150,000.

The Philadelphia & Reading has awarded a contract to the Robert E. Lamb Company, Philadelphia, for the construction of an oil storage house at Reading, Pa., to house the company's entire oil supply. The building will be built of brick and concrete, will have 44 storage tanks and will be 75 ft. by 150 ft., with a platform the same size.

The St. Louis-San Francisco contemplates the construction of a brick freight and passenger station at Springdale, Ark.

The St. Louis-San Francisco is constructing an 80-ft. by 100-ft. tank shop with company forces at Sherman, Texas. This company will construct a second track from Valley Park, Mo., to Eureka, a distance of nine miles and will double track its bridge over the Arkansas river at Tulsa, Okla.

The Southern Pacific is constructing with company forces two 40-ft. by 60-ft., one-story frame shop buildings, with concrete floors, to cost approximately $11,000. This company is also constructing a 44-ft. by 625-ft. frame car repair shop, to cost approximately $26,000.

Supply Trade News

General

The Sauerman Brothers, engineers and manufacturers, Chicago, have moved their offices from the Monadnock Block to 438 South Clinton street, Chicago.

The Pettibone-Mulliken Company, Chicago, reported in the January issue as intending to add three one-story buildings to its plant at Chicago, at a cost of approximately $800,000, has awarded a contract for these buildings to Bowie-Lydon & Company, Inc., Chicago.

The Northern Engineering Works, electric crane and hoist builders, Detroit, Mich., has made the following changes in the addresses of its local sales offices: New York City, 30 Church street, in charge of **H. C. Rood**; Philadelphia, Pa., 51 Estey building, in charge of **John H. Bricker**; Chicago, 53 West Jackson boulevard, Monadnock building, in charge of **M. H. Haeger**, of the Abell-Howe Company; St. Louis, Mo., Pontiac building, in charge of **J. S. Davidson.**

Personal

E. E. Rush has been appointed manager of the cement department of the Robert W. Hunt & Company, Chicago.

Albert H. Miller, chief metallurgist at the Midvale Steel Company's Nicetown plant, died on January 11 at his home in Ambler, Pa., at the age of 43.

Wayne Wetherill, formerly chief engineer of the Link-Belt Company, has opened an office as a consulting engineer in the Real Estate Trust building, Philadelphia, Pa.

F. Bosworth, manager of the St. Louis office of the Chain Belt Company, Milwaukee, has been transferred to Chicago, and will be succeeded by **T. F. Scannell,** manager of the Chicago office.

Mitchell A. Evans has been appointed district sales manager of the Fairmont Gas Engine & Railway Motor Car Company, Fairmont, Minn., with office at Chicago. All matter pertaining to business with railroads having general offices in Chicago will be handled through this office.

Joseph A. Boucher has been appointed sales manager of the Gifford-Wood Company, Hudson, N. Y. Mr. Boucher has been in the service of the company for more than 15 years. His first few years were spent in the company's offices at Hudson, much of his time being devoted to engineering work. He subsequently joined the sales force and later was assigned to the New York office.

Percival Chrystie, formerly vice-president of the Taylor-Wharton Iron & Steel Company, High Bridge, N. J., with which he has been associated for more than 30 years, was elected president on January 26, to succeed **Knox Taylor,** deceased. Mr. Chrystie was born in High Bridge, N. J., and started to work for the company as office boy during his school vacations. Subsequently entering the shops, he progressed through various departments until he became inspector, a position he relinquished to enter the sales department. Returning to the plant, he ultimately became superintendent of the steel foundry, then secretary and treasurer and, finally, vice-president, a posit[illegible] many years. As president of the Taylor-Wharton Iron & Steel Company he is also president of its subsidiaries, the William Wharton Jr. & Company, Inc., Easton, Pa., Tioga Steel & Iron Company, Philadelphia, and Philadelphia Roll & Machine Company, Philadelphia. Mr. Chrystie is a member of the American Iron & Steel Institute, and American Institute of Mining & Metallurgical Engineers, the Engineers' Club of New York, the Railroad Club of New York and the Manufacturers' Club of Philadelphia.

Eugene A. Balsley, associated for the past twenty years with the American Bridge Company, and **Albert E. Fisk** have opened offices at 30 North La Salle street, Chicago, under the firm name of Balsley and Fisk, for the practice of consulting engineering. Mr. Balsley was graduated from the

University of Wisconsin 1902; immediately following which he entered the service of the American Bridge Company in the Erecting Department. He was promoted to assistant manager of the plant at Fortieth street, Chicago, in 1905, and to manager of the Milwaukee plant in 1907. In 1909 he returnedto Chicago as manager of the plant at Fortieth street and remained until February, 1916, when he was appointed assistant operating manager of the Western Division and manager of the Forge Department, which position he held until January 1, 1923, when he resigned to engage in engineering practice. He is a member of the American Society of Civil Engineers and the American Society for Testing Materials. Mr. Fisk was previously engaged in engineering work with the American Bridge Company, Mead Morrison Manufacturing Company, and Freyn, Brassert and Company. He is a member of the Western Society of Engineers.

H. M. Clawson, assistant to the vice-president of the Franklin Railway Supply Company, Inc., Chicago, has resigned to become assistant eastern sales manager of the Buda Company, with headquarters at New York. He was born on July 27, 1886, at Matamoras, Pa., and entered railway service on October 1, 1904, as a clerk in the general manager's office of the Erie. On January 1, 1914, he was promoted to chief clerk to the superintendent and on June 1 of the same year was made chief clerk to the general manager, which position he held until January 1, 1915, when he was promoted to assistant chief clerk to the vice-president. From November 15, 1916, to March 1, 1920, he held the position of chief clerk to the vice-president and on the latter date resigned to enter the employ of the Locomotive Feed Water Heater Company. He left the employ of this company on March 1, 1921, when he became assistant to the vice-president of the Franklin Railway Supply Company, Inc., the position held at the time of his recent appointment.

H. M. Clawson

C. O. Congdon, district engineer of the Missouri Pacific, with headquarters at Kansas City, Mo., has been appointed vice-president and chief engineer of the T. S. Leake Construction Company, Chicago. He was born at Monticello, Ind., January 3, 1885, and graduated from Purdue University as a civil engineer in 1906. He entered railway service with the Vandalia in June, 1906, and in June, 1907, entered the engineering department of the Missouri Pacific. Appointed roadmaster on the Central Kansas division in January, 1909, he served in this capacity until June, 1909, when he re-entered the engineering department at Osawatomie, Kan. He was promoted to assistant division engineer, with headquarters at Atchison, Kan., in February, 1910, and in November, 1911, was promoted to division engineer at Coffeyville, Kan., a position he held until June, 1915, when he was transferred to Falls City, Neb. He served in the Army Transport service in France from March, 1918, to March, 1919, when he returned to the Missouri Pacific as division engineer, with headquarters at Osawatomie, Kan. In 1920 he was appointed trainmaster of the Central Kansas Colorado division, with headquarters at Hoisington, Kan., which position he held until 1921, when he was promoted to district engineer, with headquarters at Kansas City, Mo.

C. O. Congdon

H. R. Curtis, treasurer of the Melrose Park, Ill., works of the National Malleable Castings Company, was instantly killed by an automobile in Chicago on January 2. He was born on December 23, 1867, at Marion, Ala., and began his business career in 1884 with the Thompson Smiths Sons, Duncan City, Mich. On February 8, 1888, he entered the employ of the Chicago Tire & Spring Company and was appointed secretary in 1892, which position he held until 1894 when he was promoted to assistant manager. He held that position until 1896, on which date the Chicago Tire & Spring Company was acquired by the Latrobe Steel Company and he was appointed cashier of the latter company, which position he held until 1908, when he was promoted to assistant to the president. When the Latrobe Steel Company was absorbed by the National Malleable Castings Company in 1909, he was appointed treasurer of the Melrose Park branch, which position he held at the time of his death.

H. R. Curtis

William P. Waugh, consulting engineer for the H. H. Robertson Company, Pittsburgh, died at his home at Sewickley, Pa., on January 15. Mr. Waugh was born in Hedrick, Iowa, and attended Iowa State College, at Ames, Iowa. His first work after leaving college was with Frank E. House, who is now president of the Duluth & Iron Range, on construction work on the Chicago, Milwaukee & St. Paul Railway, with headquarters at Ottumwa, Iowa. His next position was with John F. Stevens at Mapletown, Iowa, on the construction of the Chicago, Milwaukee & St. Paul between Ute and Sioux City, Iowa. Subsequently Mr. Waugh was secretary to Mr. Stevens until 1888, when he left railroad work to engage in survey work in California. Subsequently he was associated consecutively with the Fort Scott (Kansas) Cement Company and with the McCormick Construcion Company at Kansas City, Missouri, being employed by that company on the construction of the St. Louis Water Works tunnel under the Mississippi River and on construction work on the Chicago drainage canal. Mr. Waugh next joined the James G. Wilson Manufacturing Company, with headquarters in St. Louis, going to New York a short time later as their sales manager in the New York district, and remaining for 12 years, when he became connected with Irving F. Orr, of the Clason Architectural Metal Works in Providence, R. I., specializing in skylight construction. Mr. Waugh then joined the H. H. Robertson Company, Pittsburgh, Pennsylvania, in the service of which he remained until his death, as noted above.

William P. Waugh

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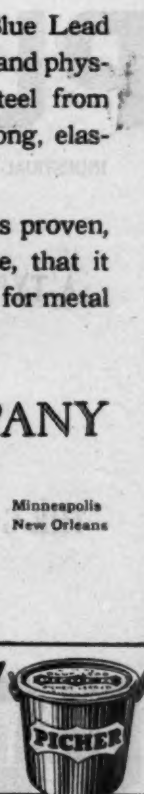

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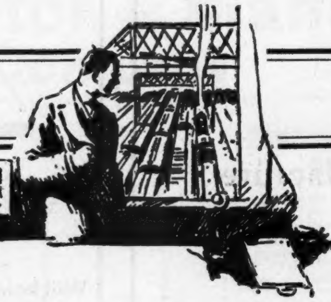

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